Analysis of Influence of Cost on Strategic Choice of Auditee/Auditor

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DECLARATION

I hereby declare that this thesis has been composed by myself and is the result carried out by myself.

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ABSTRACT

The audit of financial statements is set out as a two person game to illustrate the influence of damages imposed by society on the strategic choice of both auditee and auditor. It is assumed: (1) that society can influence the damages regime for the auditee and the auditor; (2) that society might be prepared to restrict damages if the auditor can demonstrate due diligence; (3) that the auditee can vary his level of care as regards the accounting process; (4) that the auditor controls his choice of qualitative and quantitative audit tests and the form of audit report; and (5) that there is uncertainty about material error. There are costs and damages involved. The expected cost is the direct cost of preparing and carrying out the audit of the financial statements plus possible damages incurred by both auditee and auditor whenever the quality of the financial statements and audit are challenged. The highest damages are for the issue of a non-qualified audit report on materially inaccurate financial statements, and the primary focus of the dissertation is to demonstrate how these particular damages influence the strategy of the auditee and the auditor. Two types of game are considered. The first illustration is of a game in which the auditee and the auditor cooperate to find the combined strategy that minimizes the total expected cost. The second illustration is of a game in which the auditee and the auditor do not cooperate. In this case, the joint strategies are found by using the concept of Nash equilibrium. These illustrations demonstrate that: (1) for both cooperative and non-cooperative games, the level of damages determines the auditee and the auditor strategies; (2) if society wishes to give an inducement in the form of restricting damages in order to encourage maximum effort, the size of the required inducement is less for a cooperative than for a non-cooperative game; and (3) there are some levels of inducement which encourage maximum effort irrespective of whether the auditee and the auditor cooperate.

Le temps par lui-même ne produit rien; il est seulement nécessaire pour que les énergies latentes apparaissent au jour.

Émile Durkeim

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Naturally, I accept all responsibility for any errors or omissions.

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INTRODUCTION

Growth of auditee litigation by different institutions (e.g., Security Exchange Commission (SEC)) and auditor litigation by financial statement users has increased society's awareness of audit expectations. Daily newspapers and business and financial journals over recent times have questioned the reliability and the credibility of the audited financial statements.

This dissertation looks at the interface between auditing and strategy; hence, it investigates through an audit interactive setting the influence of damages on the strategic choices of the auditee/auditor. In other words, could society influence the choice of strategies through economic factors such as the level of damages, and if so, what strategies are required by society's policy toward auditing?

We use the constructs of game theory to analyze the auditee and the auditor selected strategies from their expected economic loss. The selection of a strategy is limited by the need to meet the audit standards, the desire to minimize costs, and the power of the tools in hand. We develop a formal model of audit with a societal view to increase its welfare through audit, including the

reliability of audited financial statements. The model includes a penalty regime which incites the auditee and the auditor to work hard to avoid a report not being qualified even though the financial statements are inaccurate.

The auditee, who is an assertion preparer, has the choice between taking a high or low level of care in the preparation of accounting information; however, the auditor, who is a chartered accountant, could use a "qualitative" test and/or a more powerful "quantitative" test before making up his mind about the financial statements.

The following policy investigations centre on four possible attitudes that society might take towards the work performed by the auditee and the auditor. The first attitude is that the auditee should be employing high levels of effort in order to reduce the probability of material error. The second attitude is that the auditor should be employing a powerful quantitative test in order to increase the probability of any material error being discovered. The third attitude is that the auditor should be employing a qualitative test in order to reveal the auditee's strategy (defined on page 6). The fourth attitude is that both the auditee and the auditor should be employing high levels of effort - the auditee in order

to reduce the probability of material error, and the auditor to reveal the auditee's strategy and increase the probability of any material error being discovered.

Different levels of inducement are introduced to incite the auditor to select a qualitative test, and to analyze how inducement could be encouraged to take desirable actions to prevent a combination of non-qualified opinion and materially inaccurate statements. The inducement comes by varying the level of damage.

Background

Most prior research in audit planning has been devoted to the development of formal models of an audit or its considered constituent parts with a view to increasing the efficiency of audit planning and operation whilst decreasing the risk of litigation or loss of professional reputation. Most of them rely on a one-person decision theory which assumes that auditing takes place in a passive environment where an informational approach is valid.

This informational approach is valid when the only objective of the audit is to attest to the "accuracy" of recording transactions. The auditor uses the result of

the test on samples to certify the level of accuracy of the financial statements. It is designed to represent decision making under uncertainty which does not allow the audit to influence the behaviour of the auditee, although these behavioural influences have long been recognized (see Fellingham and Newman (1985)) by the auditor.

The auditee chooses his internal control system considering the auditor behaviour and his effort to avoid any material error within the financial statements. He could have observed the auditor's behaviour, and may know about the audit program, but not exactly about the auditor's strategy. He could be an ex-auditor himself.

The auditor chooses his audit program to detect any error within the financial statements. Through his audit test results, he tries to identify the auditee's policy on his accounting information system and detect any material error possibly left in the financial statements. Our model includes this part of audit; hence, it goes further by allowing the auditor the opportunity to observe and reveal the auditee's strategy.

Anderson and Young (1988) suggest that "auditing is a management tool useful ..., for influencing managers to take actions consistent with organizational objectives."

(p. 14). They also argue that anticipation of the audit can influence the auditee's actions. Fellingham, Newman and Patterson (1989) report that in most audit settings the outcome of the audit is not a matter of indifference to the auditee.

Therefore, according to them, audit models in a passive environment mean inappropriate conceptualization of the role of auditing, and procedures derived from these models relying on a one-person decision theory do not achieve desired levels of performance; moreover, if an auditee has incentives to choose actions different from those mandated or desired by society, sound analysis of auditing's role requires the explicit recognition of how the auditee and the auditor interact. Without this recognition, the evaluation and comparison of the effectiveness of alternative plans using audit outcomes will be biased.

Interaction between the auditee and the auditor is usual in an audit process. For example, the audit fee, as well as the extent and nature of recording and processing errors that are discovered, may depend on the accounting system used. Financial statement users question the relevance of the financial statements in regard to this interdependence by alleging collusion between the auditee and the auditor. Professional organizations, such as the

Canadian Institute of Chartered Accountants (CICA), have taken this relationship into account by establishing professional ethics and generally accepted audit standards. Cooperation or conflict could arise from interactions between auditee and auditor.

These interactions could be formulated as a game. A game is the totality of the rules which describe interaction between the auditee and the auditor; and assumes that an array of beliefs is locked together into relational patterns. In essence, games model interdependence and conflicts of interest. Interdependence means that the consequences of a player's action depend on what action the other player takes. Conflicts of interest involve the cost (allocation of resources) of getting the information.

Auditees and auditors use strategies. A strategy, according to Thomas (1984), is a complete description of the decisions an auditee (auditor) will make in all the possible situations. Auditees, by selecting and designing information systems, use other criteria than the direct cost to make up their minds. They take into account that their information system will be used as audit evidence by the auditor.

So far, few research models of auditing use the game

theoretical framework. Dent (1990) suggests that although accounting functions in a conflicting domain with divergent interest needs, research on the interface between accounting and strategy is, as yet, underdeveloped.

The game theory models the auditee and the auditor relationship by describing and solving an idealized version of reality; for example, all players are rational, intelligent, and have imperfect information. The description concerns the representation of the auditee and the auditor and their preferences, the rules and strategic possibilities, and the outcomes and payoffs.

The solution concept is the equilibrium pair. Each player maximizes his expected payoff following bargaining with the other player. Hence, neither player will have an incentive to deviate from such an outcome, given that his adversary also does not deviate, rendering it a stable point or equilibrium. This equilibrium pair of payoff specifies a strategy for each player.

The solution in the cooperative game is the combined agreed expected payoff of the game, although in the non-cooperative game it is the Nash equilibrium.

Because game theory focuses on situations in which there are two or more rational and interdependent decision makers, it is especially appropriate for analysis of influence of cost on the strategic choices of the auditee and the auditor. Each player is assumed to be a decision maker who must choose one action from among a set of possible courses of action. Each player chooses his action based on information about the expected consequences of engaging in that course of action and on an evaluation of those consequences. These evaluations provide for ranking the consequences in order of preference. The player then makes a utility-maximizing choice, based on minimizing his costs. They are interdependent, in the sense that the outcome of the game is jointly determined by the choices made by the players; that is, the choices made by one of them have an effect on the welfare of the other. This means that a given player's optimal choice cannot be determined in isolation, but depends on the choices he expects others to make.

Reformulating the audit problem in a game theoretic frame with two players may therefore provide insights into how the auditee and the auditor select strategies according to their economic cost: more precisely, can a satisfactory model, as a game, of the auditee/auditor be developed? If so, what does it say about effects of

damages, costs, or players' behaviour? Can these be set to give satisfactory results for "society"?

Whilst other researchers characterize the audit as only a non-cooperative game, this dissertation characterizes it as a cooperative as well as a non-cooperative game. By doing so it investigates the two extremes of audit behaviour situations with a regulator looking at the other players' interests.

This dissertation is organized as follows: Chapter 2, audit and game, deals with the basic knowledge of auditing, decision theory, game theory, cost estimation, and a survey of the game theory behaviour of auditing model;

Chapter 3, auditee/auditor game, specifies the auditee/auditor model by defining the two players and their strategies, and by pointing out how society can influence them within the games. It also suggests the solution to a cooperative and non-cooperative game in order to analyze the results;

Chapter 4, cooperative games, defines a "pattern" and explains how we get a combined strategy. Then, it shows and analyzes seven different patterns resulting from the cooperative game;

Chapter 5, non-cooperative games, explains how we get a joint strategy and shows and analyzes four different patterns resulting from the non-cooperative game. Afterwards, two patterns from the cooperative game are overlapped on two patterns from the non-cooperative game and the essence is analyzed.

Finally, Chapter 6, conclusion, discusses the policy implications of explicitly recognizing the influence of cost on the auditee/auditor's strategic choice, the effect of inducement, and which game, the cooperative or the non-cooperative, fits a damages regime properly managed by society. It ends by suggesting future areas for research.

Analysis and selection of audit policy need some structure. The aim of this section is to present the elements of this structure: a theoretical framework of auditing, decision theory, game theory, cost estimation, and literature of audit game theoretical settings. It is argued that whilst decision theory implies the entire responsibility of the audit outcome is placed on the auditor, game theory actually shares this responsibility between the auditee and the auditor.

Theoretical framework of auditing

What is auditing? Schandl (1978) gives this definition of auditing:

> "Auditing is a human evaluation process to establish the adherence to certain norms, resulting in an opinion (or judgment)." (p.4)

Williams (1988) adheres to this definition and presents the AAA (American Accounting Association) theoretical framework of auditing shown in Figure 1 (page 12).

This frame relies mainly on the work of Mautz and Sharaf (1961) which refers to what auditors do. To know more about the postulates, theoretical concepts, the

principles of auditing, and the auditing techniques, see Williams (1988).

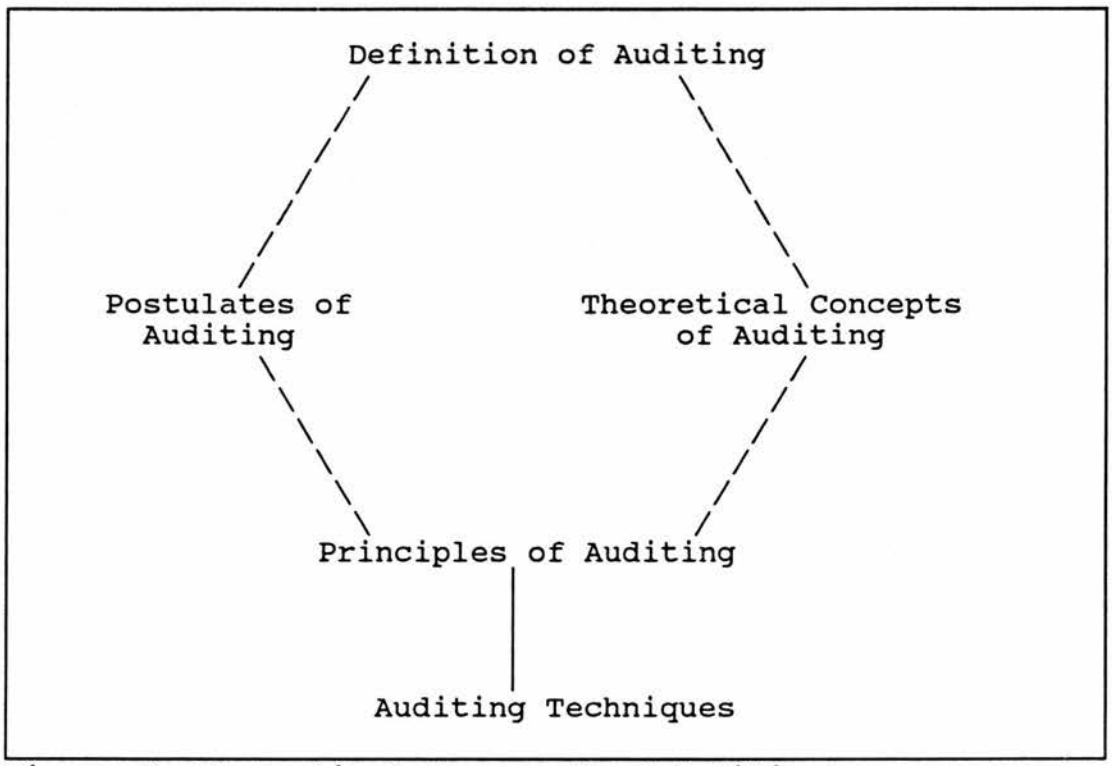


Figure 1 Theoretical Framework of Auditing

In this dissertation, we are interested in the impact of society audit policy on two of the principles of auditing: the planning of audit work; and the expression of an opinion. Further, the Statement of Auditing Standards (SAS) No. 53 expands the auditor's responsibility to detect a material error. In particular, it states:

> "The auditor should assess the risk that errors and irregularities may cause the financial statements to contain a material misstatement. Based on that assessment, the auditor should design the audit to provide reasonable

> assurance of detecting errors and irregularities that are material to the financial statements."

Indeed, auditors face problems related to the nature of strategic interactions in assessing audit risk and in planning audit tests.

Audit risk

The concept of risk is fundamental to auditing. Firstly, there is the business risk which is the risk that the auditor will suffer harm because of a client relationship, even though the audit report rendered for the client was correct. Secondly, there is the audit risk which is the risk that the auditor accepts or rejects the financial statements as free of material error. Within this dissertation, we focus on the audit risk when the auditor accepts as free of material error misstated financial statements. More technically, the SAS No 47 defines this audit risk as

> "the risk that the auditor may unknowingly fail to appropriately modify an opinion of the financial statements, that are materially misstated."

It expresses audit risk as a direct function of three types of risk: inherent risk; control risk; and detection risk.

The inherent risk is the susceptibility of an account

balance or class of transactions to error that could be material. It could be due to hazards but Weick (1988) concludes about the "inherent hazard." that

> "Hazards are not given nor do they necessarily inhere in organized activity. Instead, they are often constructed and put into place by human actors. Their development is indeterminant rather than fixed,...." (p.314).

So the "inherent risk" could come from hazard and/or construction by the auditee and/or auditor activities; it is not just a product from "nature".

The auditee and the auditor can lower this risk. Schroeder and Verrault (1987) indicate that the relative risk of an audit engagement is a function of the:

1. reputation and stability of the auditee's management
2. auditee's system of internal control
3. type of financing used by the auditee
4. nature of the auditee's business
5. auditee's rate of growth
6. independence of the auditors
7. longevity of the engagement.

The control risk is the risk that a material error could occur which would not be prevented or detected on a timely basis by the system of internal accounting control. It is the risk that the auditee's system of internal control will not prevent or correct such errors. This risk is a function of the auditee's choice of the

internal control system and his effort to take care of the accounting information.

Aldersley (1989) suggests that the auditor's assessment of control risk is essentially an elicitation process rather than a sampling process as is the case for analytical procedures and substantive testing. The auditor applies procedures that theoretically provide him with a direct measure of the control risk in a particular situation.

The detection risk is defined by International Auditing Guideline [IAG] 1 as follows:

> "In forming his opinion on the financial statements, the auditor carries out procedures designed to obtain reasonable assurance that the financial statements are properly stated in all material respects. Because of the test nature and other inherent limitations of any system of internal control, there is an unavoidable risk that even some material misstatement may remain undiscovered." (cited in Bédard (1991)).

In other words, it is the risk that any remaining material errors will not be detected by the auditor. The AICPA's SEC Practice Section, which records formal complaints against the auditor, seems to suggest that the rate of occurrence of material misstatements in audited financial statements is less than one-half percent (Kinney (1988)). Furthermore, Bédard (1991) reports that only forty-seven percent of the errors in the accounts receivable were detected and reported to the auditor

according to the field experiment performed by Caster (1990). So the auditor's procedures could not disclose all material errors. It does not necessarily include undetected management fraud which is much more often a problem than an error estimation.

SAS No. 53 states that, based on his risk assessment, the auditor should design an audit to provide reasonable assurance of detecting errors and irregularities that are material to the financial statements. He could model his audit based on the decision theory or on game theory.

Decision theory

Decision theory is characterized as looking for alternative future actions, predicting consequences, comparing consequences with preferences, and designating one alternative as the one decided on. Its contents could be descriptive or normative, although the latter supports more rationality than the former; but both share the main assumption that decision-making and decisions serve the purpose of choice. Some minor assumptions complete it.

The decision-makers search for the best action among alternatives. Decision-making solves the problem

constituted by the existence of alternative actions. The basic uncertainty thus relates to the alternatives. Furthermore, Brunsson (1990) argues that "decisions may allocate responsibility to decision makers and organisations." (p.47). Therefore, this decision theory could designate the auditor who is the decision maker and/or his organization as the only person responsible for the audit outcome.

The auditor through his audit faces three types of risk. He encounters the inherent risk which could be borne in full by the auditee, and the control risk which is essentially influenced by the auditee. Only the detection risk is under his control. However, according to the decision theory, the auditor is the only person responsible for the audit outcome; but Antle (1982), using a three-person game model, suggests that the auditee and the auditor share the audit risk.

Games theory, by modelling interdependence and conflicts of interest between the auditee and the auditor, indicates that the consequences of a player's action depend on what action the other player takes. Each player as a decision maker chooses his strategy, which influences the payoff of the game. The players share the payoff, and each gets his quota. In that way, the auditor is not the only person designated as responsible

for a non-qualified audit report when the financial statements are inaccurate. The other player, the auditee, gets some responsibility for the end product.

Within an audit, the decision theory dictates to the auditor how to solve the problem of uncertainty. He follows the rules of rational decision-making: establishing a preference function, listing all possible alternatives, describing all relevant consequences, and comparing them with the preference function.

In practice, the problem may be more difficult since the decision-makers may be uncertain or lack information about the available alternatives and about the consequences or the preferences. The normative content of decision theory handles some aspects of these complications, but not all, and this could explain why actual decision-makers do not always follow the norms of rationality. It is also possible that most decision-makers lack capacity or competence for the complicated information processing required by the rules of rational decision-making (March & Simon (1958), Huysman (1970), Kahneman & Tversky (1973), Nisbett & Ross (1982); cited in Brunsson (1990)).

Consequently, decision-makers, problems, solutions, and choice opportunities may interact haphazardly, producing

a certain randomness in choices of alternatives (Cohen et al. (1972); cited in Brunsson (1990)) while producing rational decision procedures uncertainty at the same time.

Bédard (1990) reports that

> "having auditors who are not perfectly reliable in performing compliance tests is realistic given the results of Waggoner (1990). Thus, in her experimental study, she found that auditor's accuracy in detecting control deviations was less than 60%." (p.11).

This result suggests a weakness in the audit program. Consequently, a test that includes an examination of the auditee's strategy and takes into account interaction between the auditee and the auditor should improve the auditor's accuracy within his audit program. This test could be constructed from the theory of indicators and should reveal the auditee's strategy, including his effort toward the accounting information system and his internal control system choice.

The risk borne by the auditor critically depends on the strategic interactions of the auditor and the auditee. These interactions cannot be evaluated adequately in a decision theory, and inferences based on such a model may

be seriously in error (Fellingham and Newman (1985)). Newman and Noel (1989) suggest that such an interactive environment is well suited to investigation using game-theoretic methods. Game theorists also have recognized the implications of strategic settings for statistical inferences in an audit-like environment.

Game theory

The term "game" refers to a model of any social situation involving two or more decision-makers. Each decision-maker, by involving two or more decision-makers, shares responsibility in the outcome of the game.

The essence of audit is interdependence. The latter means that the consequences to a player of taking an action depend not just on that player's action, but also on what actions the other players take.

So, a game implies at least three components: 1) a list of players, 2) a list of strategies for each player, and 3) a set of objective functions.

Mathematically, the three components are:
Players, where i = 1,2.
Strategies: s_i belongs to S_i, the strategy set for

player i.

Objective function, e.g., player i maximizes $U_i(s_i...s_T)$, that is, to minimize costs, subject to All i, s_i.

Many strategies could be eliminated by using the dominance argument. According to this principle, if a row (column) of the game matrix is always less than or equal to another row (column), then the auditor (auditee) invariably prefers to use the strategy with the least cost (greatest payoff) and the dominated strategy need not appear in the solution.

If a player's vector of payoffs under one strategy is always less than or equal to any other one of his vectors of payoffs (e.g., $e_{1j} <= e_{2j}$, where e_{ij} is the payoff to player 1 of his (i)th pure strategy versus player 2 of his (j)th pure strategy), then the player who minimizes his costs invariably prefers to use the strategy with the lowest vector of payoffs (e_{1j}). Consequently, the dominated strategy (e_{2j}) does not have to appear within the matrix solution. Thus, we can get a reduced game by using domination on one player's strategies and other players' strategies. The reduced game will only include players' strategies whose vectors of payoffs are not dominated. Thomas (1984) proved that although a dominated strategy is removed from a game, the solution of the reduced game is a solution of the original game.

Strategy is thought to constitute a logic underlying players' interactions with each other and their environment, and this in turn guides their deployment of resources. Cudd (1988) cites Jon Elster who claims that the essential feature of strategic interaction is the ability of agents to "globally maximize"; that is, to look at all possible futures, and to select the best one. However, strategy is proactive, consciously formulated prior to decisions and actions and not just a pattern in a stream of decisions. Moreover, strategies within each player are not only fabricated internally, but are constructed out of the interrelations among them.

Once the game has been specified, we can distinguish between actions (or moves) and strategies. Actions are the component elements of the game. An action is the occasion of a choice among various alternatives, to be made either by one of the players, or by some device subject to chance, under conditions precisely prescribed by the rules of the game.

A pure strategy for an auditee or auditor is a plan of action. It specifies what the auditee (auditor) will do as a function of what the auditor (auditee) knows at every juncture in the game. A randomized (mixed) strategy is a probability distribution on the auditee's (auditor's) feasible set of pure strategies. The payoff

function is linear in the randomized strategy of each player.

A strategy, because it is a plan of action, can be delegated to an agent. All the agent has to do is follow the plan embodied in the strategy. However, the main advantage of thinking in terms of strategies is that they make possible a compact representation of the game.

These strategies could be adapted to either the cooperative games, which are games with mixed interests and enforceable agreements, or to the noncooperative games which are: (1) games with strictly opposite interests (zero-sum games); and (2) games with mixed interests without enforceable agreements.

The strategies are presented in extensive (tree) form although the model can subsequently be analyzed in normal (matrix) form. Moulin (1981) defines a NN-normal form game by the following data:
Let NN be a fixed, finite society, namely a set of players (agents) with index i.
- for each player i belonging to NN a strategy set S_i with elements s_i.
- for each player i belonging to NN a utility function (or payoff) u_i, namely a mapping from $S_N = X_{(i \text{ belonging to } N)} S_i$ into R.

An element $s = (s_i)_{(i \text{ belonging to } N)}$ of S_N is called an outcome of the game.

Agent i freely selects a strategy s_i belonging to S_i the strategy for player i. Once every agent has exercised his strategic power, an outcome "a" is reached, and agent i's utility level is then $u_i(a)$.

A small set of idealizations completes this game theoretical framework. They are: 1. Rational players maximize expected utility; and 2. Solutions to games are equilibrium solutions.

1. Rational players maximize expected utility

Players are rational if they make decisions by maximizing their subjective utility. In game theory, building on the fundamental results of decision theory, we assume that each player's objective is to maximize the expected value on his own payoff, which is measured in some utility scale.

Myerson (1991) gives this illustration of the maximization theorem:

> "If a decision-maker would prefer option 1 over option 2 when event A occurs, and he would prefer option 1 over option 2 when event A does

not occur, then he should prefer option 1 over option 2 even before he learns whether event A will occur or not." (p.3).

Rational players do the best they can in their game. Their expected behaviour can be represented by a function which completely orders their objects and obeys their expected utility.

2. Solutions to games are equilibrium points

An equilibrium point is a set of equilibrium strategies, one for each of the n players in the game, so that for each player, if all the other players are playing their equilibrium strategies, then it is rational for him to do so as well.

Cost estimation

The audit could generate benefits or costs. Unfortunately, benefits do not have the same aura of reliability and objectivity that costs do. Benefits are too easily subject to manipulation: agents will have an incentive to misreport their true benefits if this strategy results in lower assessed costs. To avoid this manipulation, we use cost models, and our objective

function is to minimize cost.

Damages which are associated with expected legal costs, reputation, and penalty may be thought of as a refund paid by the auditee and/or auditor to society. The limit on the refund or penalty can be thought of as equal to the expectation of the additional profits that society loses from inaccurate audited financial statements. However, a penalty or refund cannot be unlimited since the liability of the auditee and/or the auditor would be bounded by the proven damage and/or their capacity of payments. This threat should produce equilibria in which the audit report is informative.

The strategic approach recognizes that auditee and auditor influence and react to each other's behaviour. The auditee knows that his behaviour may be detected by the auditor. The auditor anticipates that his resource allocation will influence the auditee's behaviour. He trades off his ability to influence the auditee's behaviour against the cost of the audit effort. The more he influences the auditee's behaviour the less cost he uses for the audit; consequently, the auditee's cost is greater than in the case in which he is neutral.

Thus, the benefit of an audit is attributed to its ability to minimize losses to the organization and

indirectly to society.

Literature review

There are previous audit models which use a game theoretical framework. Antle (1982) models the auditee, auditor, and owner through a game theoretic foundations of agency theory. The auditor's behaviour is modeled as an economic agent. He uses Nash equilibrium as his solution concept and confines his analysis to pure strategies. His model is a three-person game with wealth transference. He shows that the auditee and the auditor could conspire to disadvantage the owner. He suggests that the auditee has the possibility of welfare gains from sharing risk with the auditor.

Antle (1984) examines the auditor's attribute of independence. He uses his game theoretical model developed in Antle (1982), a three-person game. He also confines his analysis to pure strategies. He observes that if there is a material error in the audited financial statements, the auditee will bear some risk because of it. He concludes that owners prefer an independent auditor to one that is not independent. He suggests mechanisms by which independence might be guaranteed. One of them is the role of two types of

multiperiod effects which are based on observed long-run frequency of audit reports and changes in the market value of the auditor's services.

Fellingham and Newman (1985) model the auditee/auditor interrelationship as a non-cooperative game of imperfect information and compare the single person decision theory model to the two-person game model. The behavioural choices for the auditor relate to a choice as to whether (or not) to examine the auditee's effort level, and a choice between a qualified or an unqualified audit report. They use Nash equilibrium as their solution concept. Their examples of auditee/auditor games show that the optimality of various strategies depends on the interactions of the auditee and the auditor. They conclude that the auditor single-person decision model is inadequate to deal with strategic considerations in auditing where the audit has behavioral implications for the auditee, and that inferences based on such a model may be seriously in error.

Anderson and Young (1988) focus on how audit planning and information-gathering activities may influence the auditee. They use the auditee/auditor Fellingham and Newman (1985) model, and look at two audit issues: audit for fraud; and the use of a risk analysis model. They show the appropriateness of strategic audit planning

within a game theoretical framework. Their examples illustrate that audit plans that neglect the strategic aspect of auditing can lead to opportunity costs to the auditor.

Fellingham, Newman and Patterson (1989) describe a two-person nonzero-sum game where the auditee has multiple pure strategies for selecting the "error rate", and the auditor has two strategies ("accept or reject") based on a sampling. They derive Nash equilibria, and analyze it within their setting. They study the situation with costless perfect information, costly perfect information with fixed cost, and costly imperfect information with variable cost. Their setting shows that the auditor prefers more costless information to less, and when the auditor's information does not reveal the auditee's strategy perfectly, the auditee will always use a randomized strategy in equilibrium. They demonstrate that the auditor's decision to include information acquisition depends critically on the cost of the information. They recognize the effects of the auditor's information acquisition activities on the auditee's decisions. Their example shows that some of the basic assumptions in auditing, e.g., optimality of deterministic sample size, are inappropriate in a game theory formulation of an audit setting.

Newman and Noel (1989) set a two-person nonzero-sum game in which the auditee has two pure strategies for choosing the "error rate", and the auditor has two strategies ("accept or reject") based on a sampling. They use the same auditor's choice as Fellingham, Newman and Patterson (1989). They derive Nash equilibrium solution and analyze the auditor's trigger value (number of errors for rejecting a sampling); the probability of material error; the probability of undetected error; the probability of incorrect rejection; the probability of rejection; and they compare their results with the decision theory results. One of their results suggests that the auditee's payoffs and the auditor's payoffs might be of different value to policy-makers. The latter may prefer to use auditor payoffs as policy instruments because of the unambiguous effect on undetected errors.

Beck and Jung (1989) use a two-person nonzero-sum game to model taxpayers' reporting decisions, and characterize the tax agency's policies in an environment with uncertainty and information asymmetry. They use a sequential equilibrium solution (to know more about it, see Rubinstein (1990), p.152-183). Their analysis suggests that: (1) complexity creates uncertainty for taxpayers, so the tax agency may not have strong incentives to make any simplification; and (2) the nondisclosure of information about the tax agency audit

strategy favours it.

To sum up, several authors, through rudimentary models of the audit using a game theoretical framework of the three-person game (see Antle (1982; 1984)) and the two-person game (see Fellingham and Newman (1985); Anderson and Young (1988); Fellingham, Newman and Patterson (1989); and Newman and Noel (1989)), have commented on the supremacy of the games theory model as a characterization of the audit.

In these settings where audits provide value, auditees affect (through their own choices) the payoffs to auditors, and auditors (through their own choices) affect the payoffs to auditees. These audit settings can be regarded as interactive rather than passive, and they allow the relation between auditee and auditor and their interdependence in a social economy.

These authors' contribution has been to develop models of the audit based on games theory and to contrast them with the classical decision theory and with Bayesian theory. These decision theoretic models assume that the error rate in the population is uninfluenced by the auditor's choices. Games theory, however, recognizes that the outcome of the audit is not a matter of indifference to the auditee, and that the auditee's effort, and hence the

error rate in the population, is influenced by the auditee's anticipation of the auditor's selection of audit work.

Newman and Noel (1989) suggest that interactive or game theoretic models of auditing provide a solid foundation for formalizing and investigating audit prescriptions in professional standards, legal responsibilities imposed on the auditee and the auditor by regulatory agencies such as the SEC, and the effect of the courts and legislators on auditee and auditor liabilities. According to Moulin (1981), game theory is a useful, logical device to explore the auditee/auditor game-like situations generating tendencies to both cooperative behaviour and conflict of behaviour.

The model developed in the next chapter differs from the Antle (1982; 1984) three-person game as it is a two-person game and allows randomized strategies. Moreover, for the purpose of providing intelligent audit policies, different social damages are set. In our model behaviour on the part of the players, such as fraud, is not taken into consideration (although game theory could incorporate such behaviour) except that supplying effort is considered by both players to be an undesirable activity. Our interest is in discovering, through cooperative and non-cooperative games, how a level of

damages properly managed by society could influence the choice of auditee and auditor strategies?

Our auditor's behavioural choices are made more extensive than those offered in Fellingham and Newman (1985) by adding to them a choice as to the extent of transaction testing. Our auditee's behavioural choice is the same as Fellingham and Newman (1985), and Newman and Noel (1989), but differs from Fellingham, Newman and Patterson (1989) in that in our model, the auditee has only two pure strategies for selecting his effort level.

Through a game theoretical framework of auditing, this dissertation looks at the impact of different damages allocations from society on the behaviours of auditees and auditors. Previous research is extended by adding another auditor choice to the Fellingham and Newman (1985) model, simultaneously modelling auditee and auditor strategies within a cooperative game, and investigating the effects of the cost on the auditee/auditor strategy choices within a cooperative and a non-cooperative game.

The next chapter is concerned with the setting of an audit game theoretic model to reveal the possible audit policy.

AUDITEE/AUDITOR GAME

This section defines the two players and their strategies within the auditing game. It then points out how society, as an interested party, can affect the game. It also identifies the players' objective function and suggests a solution to both the cooperative and the non-cooperative game. Finally, numbers are specified to the different parameters and the sensitive parameters are identified.

The game consists of choices, probabilities, costs and damages. The probabilities and damages are combined and added to costs to give the expected payoffs of each possible strategy for the auditee and the auditor, who are the two players in the game.

The purpose is not to propose this specific model as a guide to select audit policy, but to illustrate the importance of a properly managed damages regime for the control of auditee and auditor behaviour.

Players

The setting uses two players: an auditee and an auditor.

Auditee

The term "auditee" refers to the assertion preparer (asserter). He can be viewed as an employee of the audited firm (person acting as an agent or trustee for other people's interests) but he "owns" the control system and has the responsibility for initiating corrective action. He is the party who provides the financial statements for the auditor to perform the "attest" function which is the role of verifying and certifying the financial statements made by him.

Auditor

The term "auditor" refers to a chartered accountant. His social status is set in a highly institutionalized rule (both normative and cognitive) for auditing as well as a social role made up of particular behaviours, relations, and expectations. Many of his procedures are enforced by public opinion, by the views of important constituents, by knowledge legitimated through the educational system, by the laws and by the definitions of negligence and prudence used by the courts. Complying with professional ethics and generally accepted audit standards, he performs, with competence and in good faith, an audit,

and renders an opinion on financial statements.

The interested party

The interested party is named "society". The term "society" refers to the population at large, inclusive of investors and other users of financial statements, but exclusive of auditees and auditors. This is adapted from the meaning ascribed to the word in the Cohen Commission Report (1978), cited in Porter (1992).

Society's interest is the study of policy-making. Lynn (1986) defines it as:

> "the study of behaviour and its consequences: the behaviour of individuals, groups, and organisations that produce or mediate the social conditions to which policymakers react." (p.379).

In our model, society is interested in the behaviour of the auditee and the auditor who produce audited financial statements and in the effects of damages imposed by regulators and courts on the auditee and the auditor. More precisely, it is concerned with unqualified financial statements when there is a material error. These worsen the social conditions and exerts pressures on policymakers to shape better audit policies.

Society uses law, regulators like SEC, and Chartered Accountant (CA) institutions to implement, represent, and monitor their audit policy. In that way, it shares the responsibility for audited financial statements between the auditee and the auditor. As an ultimate resource, the use of regulators and the court system assures the application of their policy by the auditee and the auditor. But society is not a player in the game, as its role is an a priori choice of cost functions.

The next section deals with the components of strategies.

Strategies

Strategy could be defined as a player's plan adapted to its environment. Mathematically, each player has a strategy, s_i, belonging to a set of strategies, S_i.

The game consists essentially of amending a typical statistical decision problem. The behavioural choices of auditee and auditor influence the probability of a material error observation in the financial statements. The economic burden influences the behaviour of the auditee and the auditor. Society through regulators monitors the auditee and the auditor behaviour. It is firstly interested in influencing the auditor behaviour,

as suggested by Newman and Noel (1989), which appears to be easiest to influence. He is the last one to agree that the financial statements as free from material error.

Society through regulators and the court system could influence the auditor's behaviour to protect its interest; that is, to give the right signal. It takes into account the use of a specific test by the auditor in the event of a failure to qualify a materially inaccurate set of financial statements.

The players do not know the true state of accounting information. The label (E) identifies the state of error and (NE) the state of no error of accounting information.

The auditee labelled (EE) is allowed to have preferences about the outcome of evidence. He decides what level of care he will allocate to the accounting information system. This level could be high (H) or low (L) and it is not known by the auditor. Hence, a high level of care is costlier than a low one.

The auditor, designated (OR), could choose a powerful qualitative test or powerful quantitative test or both. The qualitative tests labelled A_1 and A_2 are a different set of tests. The powerful qualitative test named A_1

Table 1 States, choices, and test outcomes

States of Accounting Information

E = The accounting information is materially in error.

NE = The accounting information is not materially in error.

Auditee's Choices

H = The auditee provides a high level of care in processing accounting information.

L = The auditee provides a low level of care in processing accounting information.

Auditor's Choices

A_1 = The auditor chooses a test to observe perfectly the auditee's choice (strategy) although it does not reveal whether there is a material error in the processing of the accounting information.

A_2 = The auditor chooses not to observe the auditee's strategy.

B_1 = An extended test capable of providing high quality evidence as to whether the accounting information is materially in error.

B_2 = A less extensive test than B_1, capable of providing evidence as to whether the accounting information is materially in error.

Q = The audit report is qualified.

NQ = The audit report is not qualified.

B Test Outcomes

o_M = The test B (B_1 or B_2) signals (i.e., provides evidence) that accounting information is materially in error.

o_{NM} = The test B signals that accounting information is not materially in error.

reveals perfectly to the auditor the auditee's strategy, but the qualitative test named A_2 does not let him know

how much effort the auditee has contributed. Moreover, the test A_2 may be no test at all. However, the auditor has the opportunity to observe the auditee level of care in preventing the occurrence of a material error before deciding on which quantitative test to choose.

The quantitative tests B_1 and B_2 are also a different set of tests. They provide a signal as to whether the accounting information is materially (o_M) or non-materially (o_{NM}) in error, but the powerful quantitative test noted B_1, which implies extended audit procedures, has higher probability of matching the state of accounting information (error or no error) than the one noted B_2. Hence a powerful test is costlier than a less powerful one. Table 1 (page 38) summarizes the states of accounting information, players' choices, and B test outcomes.

Internal control system

The internal control system is the essence of the control risk. It is the auditee's duty to design the proper internal control system and operate it adequately. Designing consists of establishing policies and procedures to assist in achieving the objective of ensuring the orderly and efficient conduct of the

entity's business. This control system must be cost beneficial.

The operative care complements the designed internal control system by allocating effort to maintaining a reliable system, ensuring timely preparation of reliable information, safeguarding assets, optimizing the use of resources and preventing and detecting error and fraud. The design and the level of operative care are influenced by the auditee and are part of the audit control risk.

Fellingham and Newman (1985) suggest three different design levels: effective internal control, weak internal control, and dependent internal control.

An effective internal control has a very operative internal control regardless of the level of care taken by the auditee. His level of care does not significantly make a difference in terms of reduced error probability.

A weak internal control has a particularly ineffective internal control independent of the level of care taken by the auditee. His level of care does not significantly make a difference in terms of reduced error probability.

A dependent internal control has an internal control highly conditional on the level of care taken by the

auditee. His level of care could make a significant difference in terms of reduced error probability.

Fellingham and Newman (1985) illustrate a very effective and a dependent internal control system. Their examples reveal that the very effective internal control system results in a pure strategy, but the dependent internal control system suggests randomized strategies. We must remember that a pure strategy for an auditee or auditor is a plan of action; it specifies what the auditee (auditor) will do as a function of what the auditor (auditee) knows at every juncture in the game. A randomized strategy is a probability distribution on the auditee's (auditor's) feasible set of pure strategies. Although we do not use these three distinctions (effective, weak or dependent internal control system), we do use what Fellingham and Newman (1985) call a dependent internal control to include the randomized strategies in our examples.

Rationality

Auditees (auditors) are rational if they make decisions by maximizing their subjective utility; for a risk-neutral auditee (auditor); that is, an auditee (auditor) whose utility functions are linear in profit, this is the

same as minimizing expected cost. The game theory model is not limited to a rational auditee (auditor), although it can accommodate an irrational auditee (auditor) if his irrational tendencies are known. However, Beck and Jung (1989); Fellingham and Newman (1985); Fellingham, Newman and Patterson (1989); and Newman and Noel (1989), set the auditee and the auditor as instantaneous rational agents.

One extreme view of economics says agents obey the rationality and optimization postulates at all times and in all circumstances. The other views have the agents making a sub-optimal approach. Over time and in repeated games, they strive to uncover better strategies; thus decisions may be expected to approach optimal behaviour. In this dissertation, we assume that agents obey the rationality and optimization postulates at all times and in all circumstances.

Intelligent

Auditees (auditors) are intelligent if they recognize each other as rational. An intelligent auditee (auditor) can put himself in the auditor's (auditee's) position and reason from his point of view.

Auditee's behaviour

Audit is an established product characterized by a relative homogeneity. There is a virtually negligible product differentiation. In general, the auditee does not highly value the rewards that a specific auditor can supply. He is not interested in the most competent audit or the most accurate statement of his financial position; instead, he wants to secure statements that he expects will have a particular impact on society, including financial markets.

Three sets of auditees hire auditors: group I - auditees that are required to hire auditors and would have done so without regulation; group II - auditees that are required to hire auditors but would not have done so without regulation; and group III - auditees that are not required to hire auditors but would strategically do so with or without regulation. As regards group III, Antle (1984) suggests that one of the auditee incentives is that the market uses the audited financial statements to evaluate their performance. But, according to Melumad and Thoman (1990), mandated auditing is a special case of an unmandated audit setting; consequently, in our setting we do not differentiate among the auditee groups although there is more than one group of them.

In seeking to minimize his costs and damages, the auditee designs the internal control system and decides what effort to make to prevent material errors. Once the internal control system is identified, this setting can be viewed only as an analysis of the auditee's effort to prevent the occurrence of material error; thus the probability of a material error is a function of both the auditee's action and some random influence.

Therefore, the auditee's behavioural choices within this setting relate to the level of care which he employs in the production of the financial statements. His behavioural choices influence the probability of material error in the production of the accounting information. His choice acknowledges the auditor's strategy because auditors usually act according to accounting rules and audit procedures which themselves respond to the auditee choices.

In equilibrium, the auditee must recognize how his reported financial statements will affect the expected audit cost assessed by the auditor, and take this into account when making his reporting decisions. It is assumed that the auditee's level of care complements the accounting information system. Although, being human, he could worsen it, it is assumed that the probability of a material error is lower given his high level of care.

It is assumed that the auditee does not make intentional errors, although the strategic approach could incorporate the possibility of both intentional and unintentional error. It is also assumed that there is no overt wish on the part of the auditee to produce financial statements with material error, e.g., fraud, but merely a wish, other things being equal, to minimize his costs. However, because high care is costly, he prefers to expend a low level (L) rather than a high level (H) of care. Thus, the auditee behaviour choices differ from that of Anderson and Young (1988) and of Shibano (cited in Newman and Noel (1989)) who assume that the auditee may wish to make a false report.

The auditee prefers the auditor to acquiesce, but the auditor would do so only when his damages are relatively low.

Auditor's behaviour

In seeking to minimize his expected damages, the auditor has two decisions to make: which audit strategies to design and what to report given his "findings". This setting assumes that both the auditee and the auditor know the probability of material error being allowed by the internal control system, and the performance

characteristics of the audit tests. We must remember that the auditee designs and operates the internal control system, and the auditor's assessment of control is an elicitation process from his understanding of the design and operation of the control environment, of the accounting system, and of control procedures. The performance characteristics of the audit tests are known from anterior audits and the statistical power of the audit test.

The behavioural choices for the auditor within this setting relate to: (1) a choice (A_1 or A_2) as to whether (or not) to examine the auditee's level of care; (2) a choice (B_1 or B_2) as to the extent of audit procedures to detect a material error; and (3) a choice as to the form of audit report issued (qualified or non-qualified). The design of test A_1 reveals more precisely than test A_2 the level of the inherent and control risk borne by the auditee. However, the design of test B_1 has higher probability than test B_2 to detect a material error (detection risk).

It is deliberate that many of the institutional characteristics of audit, such as detailed review of internal control, test of details, etc., are ignored. Inclusion of them would not alter the central issue but would make the model unmanageable. These behavioural

choices are more extensive than those offered in Fellingham and Newman (1985) in which the auditor's choices are restricted to (1) and (3).

The auditor has an incentive to examine the auditee's level of care, due to uncertainty regarding the auditee's level of care. This information may not be worthwhile or looked up.

He also has an incentive to conduct other audit tests due to uncertainty regarding the outcome of random factors affecting the audit (e.g., inherent risk). He could therefore choose from any statistical or judgmental audit procedures between an extended and not extended audit procedure to detect material error. The extended test signals at a more reliable level of confidence whether a material error has been discovered or not discovered.

It is assumed that he prefers less audit procedures than more; because additional audit work is costly, he prefers to not examine the auditee's strategy and to not extend the testing.

The interested party behaviour

It should be remembered that society is interested in the

study of the behaviour of the auditee and the auditor, and in the influence it can exert on the audit policies by allowing incentives. In our model, it is concerned with the event of a non-qualified audit opinion when the financial statements are materially inaccurate.

Society, through regulators, a court system and a properly managed damages regime, will ensure that both the auditee and the auditor work hard and report truthfully. Members of society deal with the final product; that is, the audited financial statements. The auditor is the last one who agrees to the accuracy of the financial statements. Newman and Noel (1989) suggest the use of auditor payoff as a policy instrument. Therefore, society uses incentives through its damages regimes to influence, in our model, the auditor's behaviour.

One economical way to influence the auditor's payoff is to offer an inducement associated with particular auditor behaviour. This inducement could be to set at only a percentage of the total damages otherwise suffered by the auditor in the event of a failure to qualify a materially inaccurate set of financial statements. This inducement, labelled "n", is introduced in order to recognize that where an auditor fails to qualify a materially inaccurate set of financial statements, the damages imposed by society are likely to be influenced by the care taken by

the auditor.

It is assumed that society will recognize care being taken if the auditor plays test A_1, which reveals the auditee's strategy; this restrains the auditor's damages to a percentage "n" ($n < 1.00$) of the total damages that would otherwise be incurred. The inducement "n" is a function of auditor's effort to employ test A_1. The assumption is that society would wish to give the auditor an incentive to play test A_1; hence to observe the auditee's level of effort. Thus, although the game admits the possibility of damages being imposed on the auditee, there is a presumption that the primary target of any damages would be the auditor.

The interpretation of "n" could be seen as societal intervention to motivate the auditor to perform an audit according to society's expectations; that is, the incentive. To sum up, it is assumed that society encourages the auditor to perform the test A_1 within his audit.

Potential costs and damages

Suppose that auditees and auditors are modelled as economic agents who act to maximize expected utility. Do

auditees and/or auditors then have the right incentive to work hard and report truthfully? In a single period, setting the typical solution would call for an arbitrarily large penalty such as lawsuits or termination of employment to be imposed on the auditee and/or on the auditor when shirking is detected. In a general multiperiod case, current and future period effects would both be present in the solution. This model uses expected costs and damages which fit a multiperiod framework.

The process of preparing and auditing the annual financial statements generates expected costs and damages. Audit related costs are attributable to the effort required in preparing and auditing the financial statements, and the various damages attributable to the state of accounting information coupled with the audit opinion. Therefore, costs are the costs of preparation and audit, and damages include loss of reputation when things go wrong, the costs of preparing defence, and of professional advice when challenged by a disaffected user and/or an appropriate authority.

As in Fellingham and Newman (1985), it is assumed that there are various potential costs and damages associated with the decisions of the auditee and the auditor. If the auditee takes a high level of care in processing

accounting information, his fixed cost is D_H; otherwise, it is arbitrarily set at zero. If the auditor selects test A_1 to acknowledge the auditee's strategy, his fixed cost is C_{A1}; otherwise the cost of A_2 is arbitrarily set at zero. Selection of the extended test B_1 commands a fixed cost of C_{B1}; otherwise the cost of B_2 is arbitrarily set at zero.

The tests' cost for test A_1 and test B_1 is the marginal cost; that is, the supplementary cost respectively over test A_2 and test B_2. If the audit information (group I and II of auditees) is required by a third party (e.g., an investor, stockholder, creditor, bank, or prospective buyers) or some other body monitoring the organization, such as the Securities and Exchange Commission (SEC), the auditee benefits indirectly by fulfilling the requirement. And usually he perceives the benefit to be equal to or in excess of the cost of the audit, and he therefore considers it reasonable to assume the expenses. In the case of auditees (group III) who hire an auditor anyway, as the auditee is assumed rational, the audit benefit is at least equal to its cost; but more work imposes a cost on the auditee and the auditor.

The audit cost is generally dependent on the accounting system employed and influenced by the choice of audit program. Demski and Swieringa (1974) suggest that the

auditee controls action and system choice, while the auditor controls audit program choice and they share the whole cost which they jointly influence. The auditor receives a fee net of the cost actually borne by him, and the auditee receives the balance. Consequently, the cost's alteration harms at least one of them.

The cost of tests A_2 and B_2 arbitrarily set at zero is the same as Fellingham and Newman (1985); although, in a more realistic setting, the market force would determine audit costs. However, this assumption is made strictly to simplify the analysis. Relaxing it would not alter any of the qualitative results.

In addition to the above costs, it is anticipated that specific damages, including fines, could if necessary be imposed by regulators and/or courts (society) upon auditees when they issue defective financial statements and upon auditors when they fail to qualify a materially inaccurate set of statements, or upon both of them.

The auditee, as an agent, faces costs, legal liability, and exposure risk subsequent to an audit. Beck and Jung (1989) observe that the cost borne by him represents the opportunity cost of time spent preparing extra information for the audit, professional fees paid to advisors, and disutility for the audit experience.

Consequent to his choices (see Table 1, page 38), an auditor faces legal liability and exposure risk from financial statement users, including free riders. The legal liability commands a performance of duties judged to be inadequate (negligence). The exposure risk might occur from the issuance of a technically inappropriate audit opinion.

The possible consequences of these major components are economic loss and/or impaired reputation. The costs of preparing defence under challenge can be significant even though the process of preparing and auditing the financial statements was competent. In or out of court settlements can be substantial, but have been generally diffused through the operation of professional indemnity insurance. However, too often substantial settlements could lead to a shortage of capacity in the insurance market. Consecutively to settlements, reputation is affected and subsequently revenue, job security, power, esteem from others, and/or self-esteem. Table 2 (page 54) summarizes the potential costs and damages to the auditee and the auditor.

If the auditor does not qualify and the state of accounting information is good (no material error), his expected damages are C^{NQ}_{NE} and the auditee's expected damages are D^{NQ}_{NE}; and if the state of accounting

Table 2 Costs and Damages

Auditee's cost

D_H = The auditee's direct cost of expending high level of care (H); the direct cost of low level of care (L) is arbitrarily set at zero.

Auditor's costs

C_{A1} = The auditor's direct cost of carrying out test A_1; the direct cost of test A_2 is arbitrarily set at zero.

C_{B1} = The auditor's direct cost of carrying out the extended test B_1; the direct cost of test B_2 is arbitrarily set at zero.

Auditor's damages

C^Q_E = The expected damage to the auditor of qualifying when there is material error.

C^{NQ}_E = The expected damage to the auditor of not qualifying when there is material error.

C^Q_{NE} = The expected damage to the auditor of qualifying when there is not material error.

C^{NQ}_{NE} = The expected damage to the auditor of not qualifying when there is not material error.

Auditee's damages

D^Q_E = The expected damage to the auditee of a qualified opinion, given a material error in the accounting information.

D^{NQ}_E = The expected damage to the auditee of a non-qualified opinion, given a material error in the accounting information.

D^Q_{NE} = The expected damage to the auditee of a qualified opinion, given no material error in the accounting information.

D^{NQ}_{NE} = The expected damage to the auditee of a non-qualified opinion, given no material error in the accounting information.

information is bad (material error) his expected damages

are C^{NQ}_{E} and the auditee's damages are D^{NQ}_{E}. If the auditor qualifies and the state of accounting information is good (no material error), his expected damages are C^{Q}_{NE} and the auditee's expected damages are D^{Q}_{NE}. If the auditor qualifies and the state of accounting information is bad (material error), his expected damages are C^{Q}_{E} and the auditee's expected damages are D^{Q}_{E}. These expected damages aggregate all current and future consequences of the joint actions of the auditor and auditee, including effects on revenues, costs of errors, lawsuit losses and reputation.

We will now explain the distinctions among the auditor's expected damages associated with the auditor's action and the state of accounting information.

The auditor's expected damages for a qualification outcome where an error is correctly detected (C^{Q}_{E}) are costs of negotiation and other disutility arising from dealing with the auditee.

The auditor's expected damages for a non-qualification outcome where an error is not detected (C^{NQ}_{E}) when discovered are costs of lawsuit and loss of reputation, together with any penalty which might be imposed by a regulatory authority.

The auditor's expected damages for a qualification outcome where the accounting information is not in error (C^{Q}_{NE}) are costs of negotiation and other disutility arising from dealing with the auditee, and spoiled reputation.

The auditor's expected damages for a non-qualification outcome where there is no error (C^{NQ}_{NE}) is the cost of being in the audit business; that is, there is no additional cost beyond the cost of the initial audit effort except the exposure risk or insurance cost.

The order of these damages is not straightforward. Professional auditing pronouncements typically define audit risk as the risk that the auditor has failed to qualify the audit opinion for a materially inaccurate set of financial statements. Fellingham and Newman (1985) assume that $C^{Q}_{E}<C^{NQ}_{E}$, Newman and Noel (1989) assume that $C^{NQ}_{NE}<C^{NQ}_{E}$ and $C^{Q}_{E}<C^{NQ}_{E}$, and Anderson and Young (1988) assume that $C^{NQ}_{NE}<C^{Q}_{E}<C^{Q}_{NE}<C^{NQ}_{E}$ for the auditor within their examples of the auditee/auditor game.

To sum up, C^{NQ}_{E} is the costliest, C^{NQ}_{NE} is the least costly, and C^{Q}_{NE} is costlier than C^{Q}_{E}. It is assumed, as in Anderson and Young (1988), through our model that the auditor expected relative damages are $C^{NQ}_{NE}<C^{Q}_{E}<C^{Q}_{NE}<C^{NQ}_{E}$. Hence C^{Q}_{NE} and C^{NQ}_{E} are the highest costs, with a failure to

qualify a material inaccuracy being the highest of all.

The distinctions among the auditee's expected damages associated with the auditor action and the state of accounting information are now explained.

The damages of a qualification outcome where an error is correctly detected (D^{Q}_{E}) reflects that the benefits of an error when it is not discovered are not realized. The auditee exposes himself to adverse reaction of the market to a qualification, and to other damages which should not arise if the error has not been discovered.

The damages of a non-qualification outcome where an error is not correctly detected (D^{NQ}_{E}) reflect that sometimes the benefits of error are realized. The auditee, sometimes avoids the damages discussed above when the auditor does not qualify the financial statements.

Fellingham and Newman (1985) and Newman and Noel (1989) assume $D^{NQ}_{E}<D^{Q}_{E}$. They differentiate between the auditee's damages when the accounting information is in error, given that the auditor qualifies (D^{Q}_{E}) and does not qualify (D^{NQ}_{E}) based on the probability of error discovery. They state that although the realized damage of an error when discovered may be viewed as the same in either case, the expected damages are assumed to be much

lower given no qualification because the probability of discovery with attendant damages is likely to be lower than if qualification occurred.

The damages of a qualification outcome where the accounting information is accurate (D^{Q}_{NE}) are the disutility of negotiations with the auditor, as well as instances where the absence of error is never detected but settled through negotiations. Before the auditee agrees on a qualified report, he asks the auditor to make more tests to fit the qualified report. In practice, the auditee could ask for another audit by another auditor, but by the time he will get it, the audit signal will be too late as the next year's audit could be ready.

Newman and Noel (1989) assume $D^{Q}_{NE}<D^{Q}_{E}$. They argue that although the auditee's probability of subsequent discovery is constant, the damages imposed on him are greater if it is material error that is subsequently discovered.

The damages of a non-qualification outcome where the accounting information is accurate (D^{NQ}_{NE}) are the risk of the audit business. They include the preparation, cost of consultancy, the stress, anticipation effect and the disutility of audit.

Newman and Noel (1989) posit that auditee's damages $D^{Q}_{NE}<D^{Q}_{E}$ and $D^{NQ}_{E}<D^{Q}_{E}$ implies $D^{NQ}_{NE}<D^{NQ}_{E}$ if the auditee does not have a dominant strategy. The latter formula means that the probability of discovering an error when there is none is lower than when there is an error, although within the two cases the auditor does not qualify the financial statements.

In conclusion, D^{Q}_{E} is the costliest, D^{NQ}_{NE} is the least costly, and D^{Q}_{NE} is costlier than D^{NQ}_{E} meaning that $D^{NQ}_{NE}<D^{NQ}_{E}<D^{Q}_{NE}<D^{Q}_{E}$. However, to look at the sensitivity of D^{NQ}_{E} which agrees to the auditor's action, we assume through our model that the auditee expected relative damages are $D^{NQ}_{NE}<D^{Q}_{NE}<D^{Q}_{E}$ and that $D^{NQ}_{NE}<D^{NQ}_{E}$ where there is no intention or wish to benefit from an error.

Consequently, this approach differs from that of Anderson and Young (1988), who assume that in an audit fraud setting $D^{NQ}_{E}<D^{NQ}_{NE}<D^{Q}_{NE}<D^{Q}_{E}$ where the auditee benefits from an intentional error. As the auditor selects the action to both, our dissertation looks at the simultaneous sensitivity of auditor damages C^{NQ}_{E} and auditee's damages D^{NQ}_{E}.

Probability along with potential damages

The auditee's level of care influences the accounting information system in such a way that the probability of material error (inherent and control risk) is lower given higher effort. A high and a low level of care reduce respectively to a conditional probability "p" and "q" the frequency of material error. The auditee's effort could create error. It is assumed that the auditee's high level of care does not create more error than his low effort. The probability "p" is therefore equal to or lesser than the probability "q" ($p=<q$).

Fellingham and Newman (1985) suggest the following interpretation of this characterization of "p" and "q": if both "p" and "q" are low, the internal control is very effective regardless of the level of care taken by the auditee (effective internal control); if both are high, the internal control system is particularly weak, again independent of the auditee's level of care (weak internal control); if "p" is low while "q" is high, the internal control system is highly dependent on the auditee's level of care (dependent internal control). Our model adopts the last situation with the internal control chosen by the auditee and part of his care.

Knowing the auditee's strategy (through A_1) decreases the uncertainty about the auditee's actual work. Society inducement labelled "n" weights only the auditor's

Table 3 Probabilities along with damages

p	= The probability that the accounting information is materially in error if the auditee applies high effort (H): **P(material error/H).**
q	= The probability that the accounting information is materially in error if the auditee chooses low effort (L): **P(material error/L).**
n	= The percentage of the total damage otherwise suffered by the auditor by which the authorities would agree if the auditor has employed the test A_1.
r	= The probability that the test B_1 signals a material error given there is a material error in the accounting information: **P(B_1 signals a material error / there is a material error).**
t	= The probability that the test B_1 signals a material error given there is <u>no</u> material error in the accounting information: **P(B_1 signals a material error / there is <u>no</u> material error).**
v	= The probability that the test B_2 signals a material error given there is a material error in the accounting information: **P(B_2 signal a material error / there is a material error).**
w	= The probability that the test B_2 signals a material error given there is <u>no</u> material error in the accounting information: **P(B_2 signals a material error / there is <u>no</u> material error).**

damages of non-qualifying when the accounting information is error C^{NQ}_{E}; that is, he does not qualify when the accounting information is bad (material error). Later, "n" is varied to test the sensitivity; that is, incentive is altered by society, of the game to this variable. No consideration is given in this dissertation to the effect of a similar inducement for the auditee in order to encourage high effort by the auditee. Thus, although the

game admits the possibility of damages being imposed on the auditee, there is a presumption that the primary target of any damages regime would be the auditor.

The extended test B_1 increases the power of the test B to uncover a material error (detection risk). Its probability of signalling a material error when there is a material error is "r", and of signalling a material error when there is no material error is "t" (false positive). B_2 test probability of signalling a material error when there is a material error is "v", and of signalling one when there is none is "w" (false positive).

It is assumed that "r" is equal to or greater than "v" (r >= v) and "t" is equal to or lesser than "w" (t<=w). This test B_1 is in all respects a better test than B_2. Respectively, all of these probabilities vary between zero and one and the expected damages of both players are weighted accordingly. Table 3 (page 61) summarizes the probabilities.

Formulae for payoffs

Table 4 (page 64) shows the expected damages resulting from the auditor's choice of test A (A_1 or A_2) and his

assessment before he uses a B's test. For example, the first line starting with A_1 means that the auditor has chosen test A_1, he does not qualify, and his damages are nC^{NQ}_{E} if the accounting information is in error; otherwise it is C^{NQ}_{NE}.

Table 4 n related to test A

A	Auditor's assessment	Accounting information in error	Accounting information in non-error
A_1	Not qualify	nC^{NQ}_{E}	C^{NQ}_{NE}
A_2	Not qualify	C^{NQ}_{E}	C^{NQ}_{NE}
A_1	Qualify	C^{Q}_{E}	C^{Q}_{NE}
A_2	Qualify	C^{Q}_{E}	C^{Q}_{NE}

Note that "n" weights only C^{NQ}_{E}, the damages associated with the combination of non-qualified opinion and materially inaccurate financial statements, and with the auditor's choice of test A_1.

Table 5 illustrates the consequences related to the signal of test B combined with the auditor's actions. For example, the first line starting with O_M means that the first auditor's observation is a material error (O_M), he does not qualify, and if the state of accounting information is in error he misclassifies a material error; otherwise, he classifies a non-material one correctly.

Table 5 Signal of test B

Signal	Auditor's assessment	Accounting information E	Accounting information NE
O_M	Not qualify	Misclassify a material error	Classify a non-material error correctly
O_{NM}	Not qualify	Misclassify a material error	Classify a non-material error correctly
O_M	Qualify	Classify a material error correctly	Misclassify a non-material error
O_{NM}	Qualify	Classify a material error correctly	Misclassify a non-material error

Notice that the likelihood that the auditor will observe a material error is dependent on both the auditee's strategy, since the probability of an error is affected by his level of care; and the auditor's strategy, since the tests B_1 and B_2 have different probabilities of signalling an error.

Table 6 shows the combined probabilities associated with auditor's choice and different expected damages for him. We must remember that society uses an inducement "n" if the auditor has chosen test A_1. Except when the auditor does not qualify and the accounting information is in error, his choice between tests A_1 and A_2 does not matter. For example, rpC^Q_E (left first line) means that the auditor has chosen test B_1 (probability "r"), the auditee

Table 6 Probabilities along with auditor's payoff

Payoff and probability that test B signals a material error and there is an error

Tests	Qualify		Non-Qualify(1)	
	H	L	H	L
B_1	rpC^{Q}_{E}	rqC^{Q}_{E}	$rpnC^{NQ}_{E}$	$rqnC^{NQ}_{E}$
B_2	vpC^{Q}_{E}	vqC^{Q}_{E}	$vpnC^{NQ}_{E}$	$vqnC^{NQ}_{E}$

Payoff and probability that test B signals a non-material error and there is an error

B_1	$(1-r)pC^{Q}_{E}$	$(1-r)qC^{Q}_{E}$	$(1-r)pnC^{NQ}_{E}$	$(1-r)qnC^{NQ}_{E}$
B_2	$(1-v)pC^{Q}_{E}$	$(1-v)qC^{Q}_{E}$	$(1-v)pnC^{NQ}_{E}$	$(1-v)pnC^{NQ}_{E}$

Payoff and probability that test B signals a material error and there is not an error

B_1	$t(1-p)C^{Q}_{NE}$	$t(1-q)C^{Q}_{NE}$	$t(1-p)C^{NQ}_{NE}$	$t(1-p)C^{NQ}_{NE}$
B_2	$w(1-p)C^{Q}_{NE}$	$w(1-q)C^{Q}_{NE}$	$w(1-p)C^{NQ}_{NE}$	$w(1-q)C^{NQ}_{NE}$

Payoff and probability that test B signals a non-material error and there is not an error

B_1	$(1-t)(1-p)C^{Q}_{NE}$	$(1-t)(1-q)C^{Q}_{NE}$	$(1-t)(1-p)C^{NQ}_{NE}$	$(1-t)(1-q)C^{NQ}_{NE}$
B_2	$(1-w)(1-p)C^{Q}_{NE}$	$(1-w)(1-q)C^{Q}_{NE}$	$(1-w)(1-p)C^{NQ}_{NE}$	$(1-w)(1-q)C^{NQ}_{NE}$

---

(1) This table present the results when the auditor has employed test A_1 which reveals the auditee's strategy. If he has employed test A_2, "n" when it appears is always equal to one.

has selected high care (probability "p"), the auditor qualifies, and the accounting information is in error.

A fixed cost to the extended transaction test is set so

that data describing the state of non-material error is as expensive to get as data describing the state of a material error.

Let us characterize the game in extensive form.

Extensive form

Table 7 and Table 8 show the game in extensive (tree) form. Firstly, the auditee chooses between high and low (L or H) level of care of the accounting information system. Secondly, the auditor chooses between knowing (A_1) or not knowing (A_2) the auditee's strategy that is his level of effort L or H on the accounting information system. Thirdly, he chooses between extending (B_1) or not extending (B_2) the transaction test. Observe that if he chooses A_2, he is unable to determine whether the auditee has selected L or H.

The expected payoffs of the auditee and the auditor are based on the expected costs and damages previously defined, along with the probability of incurring those damages. For example, consider the following strategy combinations: the auditee has chosen H; the auditor has chosen A_1; the auditor has chosen B_2 and does not qualify (NQ), no matter if a material error is found or not. The

Table 7 Normal form, auditee's choice H

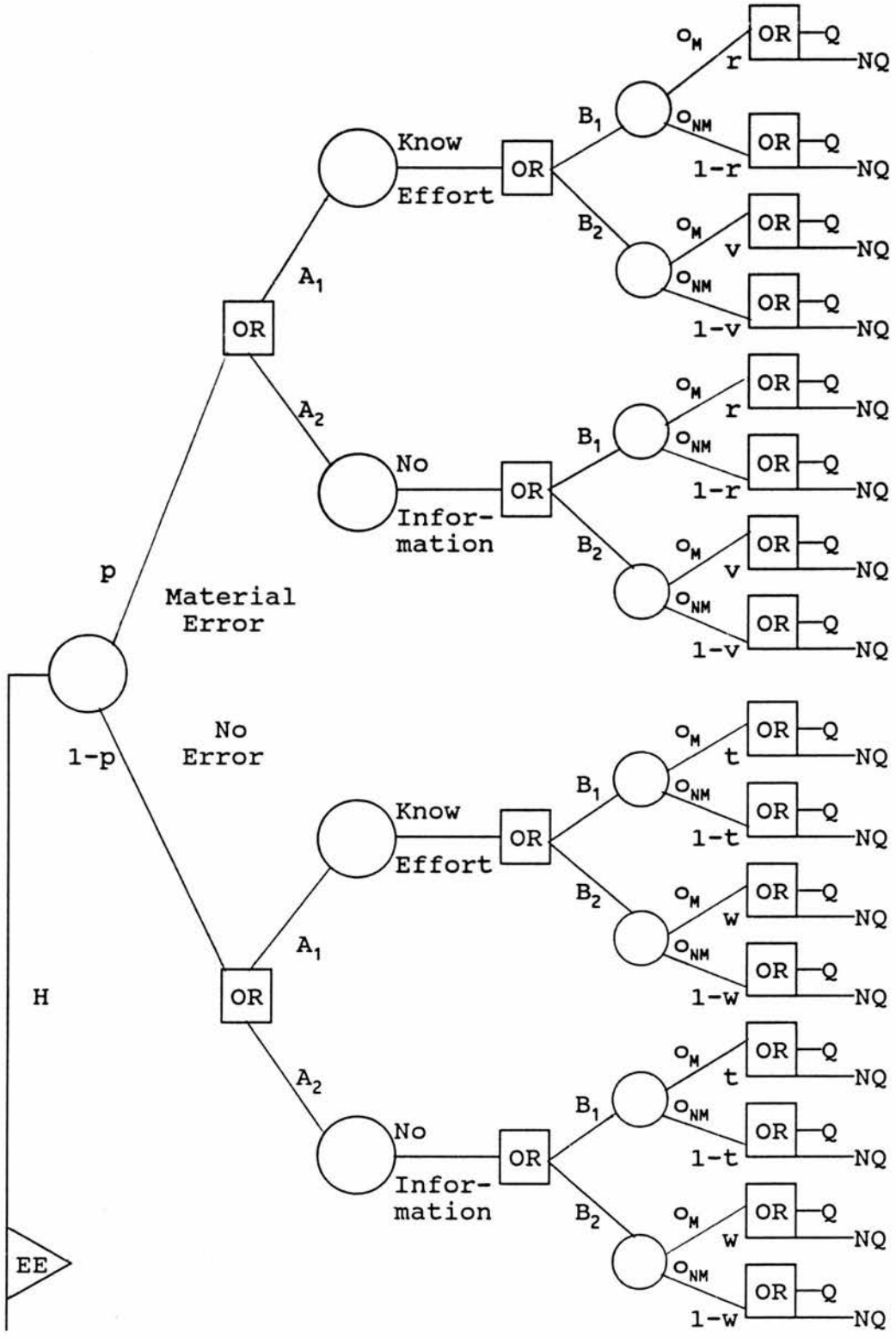
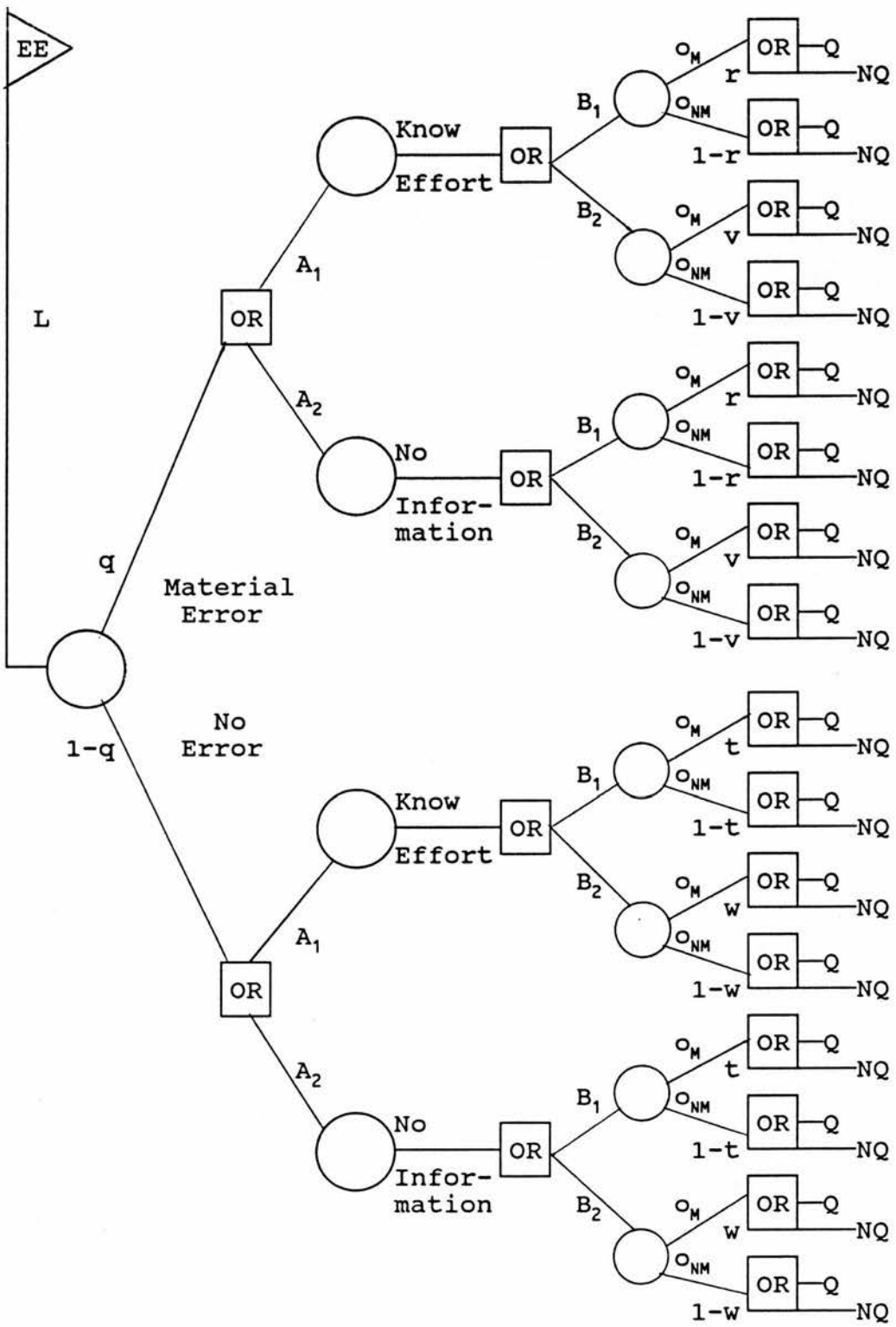


Table 8 Normal form, auditee's choice L



auditor's payoff is the sum of the expected cost and damages of:

C_{A1}, the direct cost of test A_1 ; plus

$vpnC^{NQ}_{E}$, the damages of non-qualifying an inaccurate set of financial statements, times the percentage (n) of paying the damage, times the probability (p) of error given the auditee's choice H, times the probability (v) that the test B_2 reveals a material error given that there is one; plus

$(1-v)pnC^{NQ}_{E}$, the damages of non-qualifying an inaccurate set of financial statements, times the percentage (n) of paying the damage, times the probability (p) of error given the auditee's choice H, times the probability (1-v) that the test B_2 does not reveal a material error given that there is one; plus

$w(1-p)C^{NQ}_{NE}$, the damages of non-qualifying an accurate set of financial statements, times the probability (1-p) that there is no error given the auditee's choice H, times the probability (w) that the test B_2 reveals a material error given that there is not one; plus

$(1-w)(1-p)C^{NQ}_{NE}$, the damages of non-qualifying an accurate set of financial statements, times the probability (1-p)

that there is no error given the auditee's choice H, times the probability (1-w) that the test B_2 does not reveal a material error given that there is not one.

To sum up, the auditor's total expected cost equals

$$C_{A1} + vpnC^{NQ}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}.$$

Similarly, the auditee's payoff is the sum of the expected cost and damages of:

D_H, the direct cost of expending high care; plus

vpD^{NQ}_{E}, the damages of a non-qualified audit report of an inaccurate set of financial statements, times the probability (p) of error given his choice H, times the probability (v) that the test B_2 reveals a material error given that there is one; plus

$(1-v)pD^{NQ}_{E}$, the damages of a non-qualified audit report of an inaccurate set of financial statements, times the probability (p) of error given his choice H, times the probability (1-v) that the test B_2 does not reveal a material error given that there is one; plus

$w(1-p)D^{NQ}_{NE}$, the damages of a non-qualified audit report of an accurate set of financial statements, times the

probability (1-p) that there is no error given his choice H, times the probability (w) that the test B_2 reveals a material error given that there is not one; plus

$(1-w)(1-p)D^{NQ}_{NE}$, the damages of a non-qualified audit report of an accurate set of financial statements, times the probability (1-p) that there is no error given his choice H, times the probability (1-w) that the test B_2 does not reveal a material error given that there is not one.

To sum up, the auditee's total expected cost equals

$$D_H + vpD^{NQ}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}.$$

This game is more easily analyzed in normal form.

Normal form

A normal (strategic) form representation of the game consists of sets of possible strategies, one for auditor and one for auditee, and the payoffs to auditor and auditee for each combination of strategies. Their strategies and their outcomes for a game are depicted as a matrix. Each player must choose a strategy based solely on the information in this matrix, with the goal

of maximizing his welfare. An important feature of such representation is that, even though the auditee and the auditor may move sequentially in the game, they "play" their strategies simultaneously. Since the outcome of either choice depends partly on the choice made by the other player; that is, both simultaneous choices determine a joint outcome, the information about the strategy of each player is crucial. The payoff matrix is assumed to be common knowledge; that is, the auditor and the auditee know all the payoffs of both players.

The available strategies of the auditee are simply L or H. The possible strategies of the auditor, somewhat complex due to the sequential nature of the game, are a combination of A_1 or A_2, and B_1 or B_2, and of his action Q or NQ. The auditor strategy notation differs according to whether he uses test A_2 or A_1. If he selects the test A_2 he does not care about the auditee's strategy. He is interested in one of the tests B_1 or B_2. His strategy notation is **s** followed by the number 1 or 2 showing which either test B_1 or test B_2 and the capital letter representing his action, e.g., s_{2Z}. If he selects test A_1, he minds the auditee's strategy. His strategy notation is **s** followed by two choices of the number 1 or 2 and the capital letter representing his choice for each possible auditee's strategy, e.g., s_{2Z2Z}.

Table 9 Normal form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{2z}	A_2:B_2:	NQ,NQ	$[vpC^{NQ}_E + (1-v)pC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[vqC^{NQ}_E + (1-v)qC^{NQ}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{NQ}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{2zzz}	H,B_2:	NQ,NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_E + (1-v)qnC^{NQ}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{NQ}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
	L,B_2:	NQ,NQ		

Table 9 shows the strategies s_{2z} and s_{2zzz} in the normal form and their payoff. The auditor's strategy labelled s_{2z} means that the auditor has chosen the test A_2, which does not reveal the auditee's strategy, he has chosen test B_2, the least fierce detection test, and he does not qualify, no matter whether a material error is found or not. The auditor's strategy labelled s_{2zzz} means that the auditor has chosen the test A_1, which reveals the auditee's strategy, he has chosen test B_2, the least fierce detection test, and he does not qualify no matter whether a material error is found or not. The outcome for each auditee's strategy (H and L) combined to the auditor's strategy is under the expected payoff.

Appendix 1 (page 200) shows the seventy-two auditor strategies and two auditee strategies and their joint outcome (one hundred and forty-four) of the payoff matrix.

It should be remembered that if the auditor chooses, e.g., s_{2Z}, not to know the auditee's strategy, the outcome (qualified, non-qualified) cannot be contingent on the auditee's choice, L or H, since the auditor does not know that choice.

Objective function

The objective function is formulated as one to minimize the expected payoff which is consistent with Beck and Jung (1989); Fellingham and Newman (1985); Fellingham, Newman and Patterson (1989); and Newman and Noel (1989).

To analyze this game a solution is needed.

Solution

The "solution" upon which the auditee and the auditor will agree in a cooperative game is the set of strategies which minimizes the sum of the auditee and the auditor

payoff. Antle (1984) says that the "[c]ooperative equilibrium concepts assume that the players can make binding commitments before the game is played." (p.6). Therefore, the auditee and the auditor form a coalition; that is, they act as a one player and play a combined agreed set of strategies with the aim of maximizing the total payoff; that is, minimizing the total cost of the game.

The solution concept of this cooperative game adapts the n-person cooperative solution concept in game theory to its aim of minimizing the total cost of the cooperative game. This solution uses a characteristic function "$\mathcal{V}$".

Thomas (1984) defines it as follow:

> "The characteristic function of an n-person game assigns to each subset S of the players the maximum value $\mathcal{V}(S)$ that coalition S can guarantee itself by coordinating the strategies of its members, no matter what the other players do." (p.82).

The reason for choosing the n-person game approach (even though n is only two), rather than the two person non-zero sum game bargaining solution based on the Nash bargaining solution approach, is that in the auditee/auditor game there are side payments in that the

auditee pays the auditor a fee. The n-person game assumes this is the case and so the solution splits into two parts: 1) which coalitions will form and how will the members of the coalition play the game so as to maximize the reward of the coalition; and 2) how will the coalition divide their reward among its members. The bargaining solutions assume that there is no side payment and so each player gets what the game gives him. Thus the two stages described above are combined as the players bargain over what to play and what their reward will be at the same time.

In any essential two person game; that is, a coalition providing a reward, it is clear that the coalition that will form is the two players working together. An essential game is a game it pays to form a coalition and not only a game where the characteristic function value is only additive; meaning there is no reward to work together and each player is better off alone. So one is interested in the characteristic function value of the auditee and the auditor working together; that is, what is the minimum combined cost (maximum reward) they can ensure in this cooperative game working together. Thus the characteristic function value of the coalition of both of them is the minimization of combined costs, and so we are interested in knowing what strategies give this characteristic value.

Note that we do not intend in this dissertation to look at the subsequent problem of how the two parties share out these costs; that is, what is the fee structure, as our primary interest in the game is what are the actual strategies the players will play, not what is their final reward.

The "solution" in a non-cooperative game is quite different. Consider a game involving two players; given their motivation and complete information each wants to choose an action which is best. Assume that whatever action is ultimately chosen by the other, one's own action should be a best response. To this point, each player selects a single strategy with certainty. It may be in the best interest of both parties to use randomized strategies.

John Nash (1950) proved that an equilibrium point in randomized strategies exists for every finite complete information game, and this has subsequently been called the Nash equilibrium ($u_i(s_i^*, s_{-i}^*) >= u_i(s_i, s_{-i}^*)$). Thus, there will always exist at least one such solution, although it does not need to be a pure one.

Equilibrium means a list of strategies (pure or randomized), one for the auditee and one for the auditor, with the property that no player would like unilaterally

to change his strategy. In other words, for the auditee (auditor), his strategy in the equilibrium is a best response to the other's strategies in the equilibrium, where "goodness" of strategy is determined by the auditee's (auditor's) utility function. An equilibrium point is an n-tuple of randomized strategies such that each player's randomized strategy maximizes his payoff if the strategies of the others are held fixed. Thus each player's strategy is optimal against those of the other.

Randomized or mixed strategies are strategies in which the player assigns a probability p_i to the pure strategy s_i, where summation of p_i equals one. For example, the auditor may choose to play strategy s_{2Z} with probability 0.33 and s_{1X} with probability 0.67; similarly, the auditee may randomize over high and low level. Random strategies are often observed in a real audit setting. Auditee randomizes because he is oscillatory between two pure equilibrium points, one which favours him, one the auditor. This is some sort of "compromise solution", which means equilibrium gets played occasionally according to a random process. Many of the examples we consider in the next section exhibit this characteristic.

One of the implications of an auditor playing randomized strategies is to originate uncertainty about his strategy's choice, not a dominant one, for the auditee.

The latter in this situation may work harder.

All pure strategies are contained in the set of randomized strategies. The pure strategy selected is assigned a probability of one and all other strategies are assigned a probability of zero.

The central concept of non-cooperative game theory - the equilibrium - is driven by the auditee's (auditor's) intelligence. Only in the trivial cases, where the auditee or auditor has a dominant mode of behaviour (that is, a mode of behaviour which maximizes his expected utility regardless of what the other does) can the requirement of intelligence be relaxed. Although they have preferences based on self interest, none of them has a dominant mode of behaviour within this setting.

The Nash equilibrium is an appealing solution concept for non-cooperative games for two reasons: first, because being best responses to the best responses of the others, they are inherently stable points once reached; that is, no one has any incentive to deviate (stability); and second, players can discover the stable points merely by reflecting on what their best responses are to the other's best response strategies (feasibility). It is a prediction about how the rational and intelligent auditee and auditor will compete.

Hansen and Samuelson (1988) suggest that the Nash equilibrium is self-enforcing the rational behaviour of the players. Rubinstein (1990) suggests that:

> "equilibrium points can be viewed in ways other than as self-enforcing agreements. For example, they can be viewed as a strategy n-tuples with the property that if, for some extraneous reason, they 'come to the fore' or are suggested to the players, there will be no tendency to move away from them.
> Alternatively, they can be viewed as providing only a necessary condition for a satisfactory theory of non-cooperative games: if a theory is to 'recommend' a specific strategy to each player, then the n-tuple of the recommended strategies must be in equilibrium". (p.105-106)

In some games the Nash equilibrium may involve a deterministic choice. When the Nash equilibrium is such that each player chooses a single deterministic action, there exists an equilibrium in pure strategies. However, given the payoffs, a Nash equilibrium in pure strategies could not exist; but it can still exist as randomized strategies.

A low-pooling equilibrium will exist when damages are so large in relation to the audit benefit that the maximum

damages (or the tools in hand) anticipated by the auditee and/or auditor are insufficient to induce any auditee and/or auditor to work hard.

Summary

As in any theoretical research, numerous assumptions are made in constructing the model. We will now summarize a few assumptions.

1. Many of the complexities of the relationship between auditor and auditee are not considered in the following analysis. The major simplification is the two-person framework.

2. For expositional convenience both the auditee and the auditor are risk-neutral, consistent with Fellingham and Newman (1985); Fellingham, Newman and Patterson (1989); and Beck and Jung (1989). Although neither auditees nor auditors are homogeneous group, it is assumed that members of both groups have similar preferences concerning minimizing their costs. Note that this assumption allows for disagreement concerning "tactics", i.e., about the details of implementing an agreement. Gaa (1990) reports that as long as disagreements on the "details" are overshadowed by an overarching desire to reach an agreement, no serious difficulties arise.

3. All players know the preferences and payoffs of their opponents. The payoff matrix is therefore assumed to be common knowledge; that is, the auditee and the auditor know all the payoffs and society inducements of both players.

4. All players agree on all model parameters and view each other as rational.

5. The analysis has been restricted to settings in which the auditee chooses between high or low level of care and the auditor chooses between knowing the auditee's strategy or not, using a powerful test or not, and qualifying or non-qualifying the audit opinion. In more realistic settings, the auditee can make different levels of care at different costs; and the auditor can acquire different "amounts" of information at different costs.

Many of these simplifying assumptions have been investigated by game theorists. For example, Harsanyi (1967, 1968a,1968b) has shown that lack of knowledge of preferences or payoffs does not alter the basic representation of a game.

The solution of these games depends on parameter values.

Examples of auditor-auditee game

Shubik (1983) states that:

> "when we model decision makers who are acting as fiduciaries for assets owned by others, it is generally a fair approximation to ascribe to them monetary cardinal utilities." (p.101).

In practice, auditors are partners and auditees lose money proportional to the firm losses. However, to get around the difficulty and for the purpose of making predictions about the outcome, the utility of each player is assumed equal to his monetary cost (payoff); that is, the preference of the two players is identical and risk-neutral.

The illustration of the auditee/auditor game requires specific parameters for the various costs and damages in the payoff matrix, along with estimates of conditional probabilities. The internal control system is set as dependent internal control which is highly dependent on the auditee level of care. Our estimate of specific parameters are based on the Fellingham and Newman (1985) pattern of estimate cost and some parameters are the same. They use parameters figuring relative costs which are not intended to be a faithful compilation of realistic costs.

The specific parameter values of the various costs, damages except C^{NQ}_{E} and D^{NQ}_{E}, and conditional probabilities

other than the inducement "n" are of little importance to the central theme of this study. The value of damages C^{NQ}_{E} and D^{NQ}_{E} and the inducement "n" are varied to test the sensitivity of the various solutions for both the cooperative and non-cooperative games.

Auditee's parameters

The auditee has one cost: D_H, and four different damages: D^{Q}_{E} , D^{Q}_{NE} , D^{NQ}_{E} , D^{NQ}_{NE} .

The cost of taking care over the accounting information at a high level is set as follows:

$$D_H = 35$$

The D_H's cost is the one suggested in Fellingham and Newman (1985).

It should be remembered that we assume that the auditee expected relative damages are $D^{NQ}_{NE}<D^{Q}_{NE}<D^{Q}_{E}$ and that $D^{NQ}_{NE}<D^{NQ}_{E}$. In this dissertation, following the Fellingham and Newman (1985) approach, we set these values:

$$D^{Q}_{E} = 220,\ D^{Q}_{NE} = 120,\ D^{NQ}_{NE} = 10$$

The sensitivity of the game to values of D^{NQ}_{E} above 10 is investigated, where D^{NQ}_{E} is taken to incorporate any damages by society against the auditee for issuing materially inaccurate statements. Consequently, damages

for D^{NQ}_{E} set under or above the fixed parameters for D^{Q}_{E} = 220 and D^{Q}_{NE} = 120 allow D^{NQ}_{E} to be both less or more than those damages.

It should be emphasized that these costs and damages are not intended to be a faithful compilation of realistic costs, but, like Fellingham and Newman (1985), just representative of costs.

Auditor's parameters

The auditor has two different costs: C_{A1} , C_{B1}, and four different damages: C^{Q}_{E} , C^{Q}_{NE} , C^{NQ}_{NE} , C^{NQ}_{E} .

The cost of conducting the audit work is set as follows:

$$C_{A1} = 5,\ C_{B1} = 3.$$

The C_{A1}'s cost is the one suggested in Fellingham and Newman (1985).

It should be remembered that it is assumed that C^{NQ}_{E} is greater than C^{Q}_{NE} which is greater than C^{Q}_{E} which is greater than C^{NQ}_{NE}, and in the version of the game whose properties are investigated in this dissertation the following values are set:

$$C^{Q}_{E} = 20,\ C^{Q}_{NE} = 40,\ C^{NQ}_{NE} = 10.$$

The damages of C^{Q}_{E} are those suggested in Fellingham and Newman (1985). C^{NQ}_{NE} is not set to zero as reputation

damages can still be incurred if the auditee has subsequent financial difficulties or fraud is discovered.

The dissertation investigates the sensitivity of the game to values of C^{NQ}_E equal to and above 40. C^{NQ}_E includes any damages imposed by society when the auditor fails to qualify a materially incorrect set of statements.

The main concerns for the auditor are mismatches between the audit opinion and the condition of the financial statements, with C^{NQ}_E being the highest damages; that is, a failure to qualify a material inaccuracy is the highest damages of all.

It could be argued that the damages C^{Q}_E should be different in the cooperative game from the non-cooperative one. The argument is that the reputation of the auditor is more affected when he qualifies, and the risk of loss of the auditee is higher in a non-cooperative game than in a cooperative game. However, in this dissertation, these costs are not varied for the cooperative and non-cooperative versions of the game.

Probabilities

Aldersley (1989) cites Kinney who uses an example in which the auditor believes that 400 of 1,000 audit

clients have book values containing a material error. This means that the probability of a material error is .4. Fellingham and Newman (1985) set the probability of a material error being left in the financial statements at five percent (r = .05) when the auditee works hard and, like Kinney, at forty percent (q = .40) otherwise, in their second example. Our examples do not use forty percent (q = .40) as a benchmark. In our examples, the Fellingham and Newman (1985) probabilities eliminate at least one strategy, although it is there at "q" slightly lower or higher than 0.40. Consequently, we set q = 0.25 that is at less than Kinney and Fellingham and Newman (1985) suggestion.

In the version of the game whose properties are investigated the probabilities are set as follows:

p = .05, q = .35, r = .95, t = .10, v = .80, and w = .25

The sensitivity of the model to these parameters is not reported in this paper which investigates the sensitivity to different damages imposed by society. Fellingham and Newman (1985) investigate the game's sensitivity to p and q.

Assuming it is social policy to promote certain behaviour patterns for both auditee and auditor, the next chapter

presents an example of the cooperative game and then the implications of social policy for the damages regime are revealed.

COOPERATIVE GAMES

The idea of looking at the cooperative game in audit is not a new one. Demski and Swieringa (1974) argued that "the auditor and auditee do communicate and do enter into mutually agreed upon arrangements. Hence, we shall focus on a cooperative analysis." (p.509). They also said, "the auditor and auditee jointly share in the consequences they jointly produce; and they coordinate these choices to the extent of, other things being equal, not compromising each other." (p.510). They formulate a cooperative environment in audit viewed as a Bayesian decision problem maximizing subjective expected utility for the auditee and the auditor. They conclude that some problems identified strictly from the auditor's viewpoint may not be optimal.

Rubinstein (1990) writes that: "the cooperative theory requires communication as well as commitment and contracting power; and it is a priori concerned with all feasible outcomes." (p.106). Fellingham, Newman, and Patterson (1989) define a cooperative game as: "(1) games with strictly identical interests (commitments are unnecessary) and (2) games with mixed interests and enforceable agreements." (p.4). The incentives to cooperate rely on all actors accepting and playing the

game. They act together, with a common purpose, and believe it is better to do so. They know how to interact and how people perceive their action.

They form a coalition where both the auditee and the auditor work together. We are therefore interested in the characteristic function value of the auditee and the auditor which minimizes the combined cost they can ensure by working together, and in what are the strategies given by the payoff of this characteristic function value. As long as the auditee and the auditor keep their agreement in the repeated games, they can share the maximum expected reward (payoff).

They contract between them, commit, and, ideally, make visible their cooperation. Some self-enforcing collusive arrangement might be sought, perhaps at the expense of third parties. Antle (1982) suggests an example where the auditee and the auditor conspire to disadvantage the owners.

Given the closeness of relations between auditees and auditors, which makes cooperation feasible, and the intense market pressures to reduce audit fees, it could be suggested that the current audit environment is one which promotes cooperation to keep down the expected total costs of the audit; indeed, it is arguable that

the implication of the lower total payoffs for the cooperative version of the game is that cooperation between auditee and auditor should be encouraged as a matter of social policy. Therefore, it is assumed that the auditee and the auditor have a 1:1 valuation on the transfer of money, and that they will cooperate to minimize the combined expected payoff from the game.

Our cooperative game illustration of the influence of cost on the strategic choice of auditee/auditor does not address the question of whether it is the auditee or the auditor who should pay the damages. Our premise is that society is interested in the effect of damages policy on the auditee/auditor and not in the bargaining between the two players.

Possible policy objectives considered are: (1) to induce the auditee to make high effort; (2) to induce the auditor to select a qualification outcome dependent on the result of a test signalling whether there is a material error; (3) to induce the auditor to employ a test revealing the auditee's strategy; and (4) to induce the auditee to make high effort and induce the auditor to employ the test revealing the auditee's strategy, and a qualification outcome dependent on the result of the test signalling whether there is a material error. We will discuss the implications of these alternatives for each

variant of seven different "patterns"; and the implications of each of these alternatives for the overall seven different "patterns" revealed by the cooperative game.

The remainder of this chapter is organized as follows. In the next section, the meaning of a "pattern" is defined, how to select the combined strategies is explained, and the pattern building is illustrated. In the following sections, the analysis of seven different patterns and the overall patterns are presented. The conclusion is contained in the final section.

Meaning and building of pattern

A pattern shows a picture (e.g., pattern one, Figure 5, page 103) of the spaces occupied by the same combined strategies in response to the effects of three variables. First variable is the amount of damages for the auditor associated with the combination of non-qualified opinion and materially inaccurate statements, C^{NQ}_{E}, and this lies on the x axis. Second variable is the amount of damages for the auditee associated with the combination of non-qualified opinion and materially inaccurate statements, D^{NQ}_{E}, and this lies on the Y axis. Lastly, there is "n", which is the range of inducement for the auditor to use

test A_1, in order to reveal the auditee strategy. The value of "n" is shown at the centre of the top of the picture. The effect of varying "n" affects only the variable C^{NQ}_E (X axis). Let us look at how to choose the combined strategy.

Choice of the combined strategies

It should be remembered that the cooperative solution uses a characteristic function "$\mathcal{V}$". The latter assigns a minimum payoff (cost) to each coalition of the auditee and the auditor. We are interested in the coordinated strategies having the coalition's minimum payoff of the game. Within our game, the identification of the minimum payoff is relatively easy because the auditee has only two strategies. Appendix A.2 (page 215) shows the payoffs of the possible strategies within a society damages regime with the following parameters investigated: $C^{NQ}_E = 40$, $D^{NQ}_E = 10$ and $n = 1.00$.

For example, the payoff of the auditor's strategy S_{1K} and of the auditee's strategy H is 42.00 and 160.00 (page 215, Table 1.1 under "H Auditor" and "H Auditee"). The coalition payoff, named subsequently combined payoff, which is the sum of the auditor's and auditee's payoff, is 202.00; that is, 42.00 + 160.00 (under "H Coop").

Different extensions of Table from .1 to .5 are used, according to different auditor choices of tests. For example, the extension .1 refers to auditor's choice of test A_2; and extensions .2 to .5 refer to his choice of test A_1.

The minimum combined auditee's and auditor's payoff for each coalition of each Table's extension (.1, .2, .3, .4, .5) is summarized at the top of page 215 under "Coop H" and "Coop L". The minimum payoff of all the coalition appears at the line "MINIMUM". It indicates in which extension of table to find the combined strategies having the coalition's minimum payoff of the game.

For example, the minimum combined payoff is 30.50 under "Coop L" (the right column). This number is also in line with Table .1's extension. We look at Table 1.1 under "L Coop" and find 30.50, which is the sum of the auditor's payoff, 20.50, (under "L Auditor" column) and the auditee's payoff, 10.00, (under "L Auditee" column). It indicates the auditor's strategy S_{2Z} connected with the auditee's strategy L; and the combined strategy is named L_{2Z}.

To find the space's limits of the combined strategy, we change the auditor amount of damages on x axis until the actual combined strategy shifts to another combined

strategy.

Appendix A.3 (page 220) shows the combined payoff for C^{NQ}_E = 126 in Table 2 and for C^{NQ}_E = 127 in Table 3. For example, in Table 2.1, the auditor's damages on the x axis, is 60.60. The latter points out the combined strategy L_{22}, the same as in Table 1.1 (see appendix A.2, page 215). However, in Table 3.1, the auditor's damages on the x axis (C^{NQ}_E = 127) is 60.85, which points out the combined strategy H_{22}. We do the same process for the auditee's damages on the y axis and we get the limits of this combined strategy. Let us look at pattern one as an illustration of pattern building.

Building pattern one

The "solution" upon which the auditee and the auditor agree in a cooperative game is the combined strategy that minimizes the sum of the auditee and the auditor costs. The first depiction sets n = 1.00, meaning society does not recognize the auditor's effort when he has employed test A_1 which reveals to him the auditee strategy. Table 10 shows the combined strategies in a cooperative game for different damages (C^{NQ}_E, D^{NQ}_E).

Table 10 Cooperative game n = 1.00

n = 1.00

Combined Strategy	Space intercepts: Auditor C^{NQ}_E	Auditee D^{NQ}_E	Expected pay-offs
L_{2K}	>42,512	>42,482	188.00
H_{1X}	574<<42,512	544<<42,482	83.16 - 187.99
H_{2Z}	127<<574	97<<544	60.85 - 83.15
L_{2Z}	40<<127	10<<97	30.50 - 60.60

The letter "n" (n = 1.00) indicates no inducement if the auditor chooses test A_1. The identification of the combined strategy within the range of damages is displayed under "Combined Strategy". The numbers under "Auditor C^{NQ}_E" (>42,512) and under "Auditee D^{NQ}_E" (>42,482) indicate respectively the range of the auditor and auditee damages. The number(s) under "Expected Payoff" (188.00) represent the sum (or range) of expected costs associated with the range of damages for the auditee and the auditor and the other fixed variables. The maximum amount of damages uses in the examples for C^{NQ}_E or D^{NQ}_E is damages equal to 999,999.

Figure 2 shows schematically (not to scale) the combined strategies within the auditee and the auditor damages spaces corresponding to Table 10. For example, if

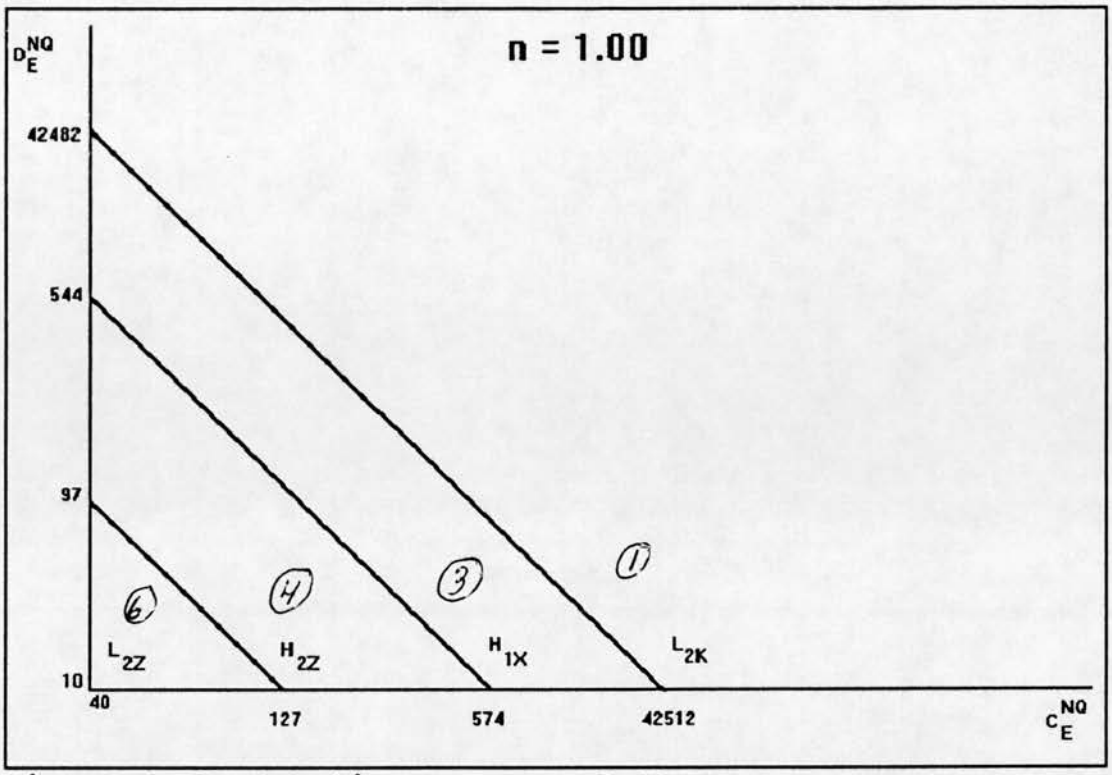


Figure 2 Cooperative game n = 1.00

society imposes damages to the auditor and auditee such that C^{NQ}_E and D^{NQ}_E are within space 3 of Figure 2, then the solution to the game is the strategy (H_{1X}).

We will now explain the notation used for the combined strategy. The capital letters L and H mean respectively Low level and High level of care taken by the auditee in respect to the accounting information. A subscript to capital letter L or H could be without or with a dash (--) and refers to the auditor's choice between tests A_2 and A_1. The absence of a dash, as in our example (H_{1X}, space 3, Figure 2), means the auditor has chosen A_2. A dash within the subscript (e.g., H_{1X--}, space 3.1, Figure 6, page 109) means the auditor has chosen A_1. The place of a

dash within the subscript also indicates the auditee strategy, as do the capital letters L and H. If the dash comes first, it means the auditee has chosen L (low level of care). If the dash comes last, it means the auditee has chosen H (high level of care). The subscript number and subscript capital letter indicate respectively the auditor choice between tests B and his action.

The subscript number itself refers to the auditor's choice between tests B_1 and B_2. The subscript digit "1" (H_{1X}) means the auditor has chosen test B_1, and the subscript digit "2" means he has chosen B_2. The subscript capital letter refers to the auditor's action: K = Q,Q; X = Q,NQ; Y = NQ,Q; and Z = NQ,NQ.

For example, if society and/or a regulator impose damages against the auditee and the auditor such that D^{NQ}_E and C^{NQ}_E fall within space 3 of Figure 2, then the solution in the game as shown in Table 10 is the combined strategy H_{1X}. The H means the auditee has chosen High level of care; the absence of a dash means the auditor has chosen A_2 and therefore he does not know that the auditee's strategy has been carried out; the subscript digit "1" shows he has chosen the extended test B_1; and the subscript capital letter "X" (Q,NQ) indicates he qualifies the audit opinion if test B_1 signals a material error; otherwise, he does not qualify. To sum up, the auditee

strategy H is connected with the auditor strategy s_{1X} $(A_2, B_1{:}Q, NQ)$ and we label it H_{1X}.

The calculation uses for the expected payoff is now explained. For example, the calculation of the expected payoff for H_{1X} in Table 10 is the sum of the auditee and the auditor costs and damages along with the probabilities, as follows:

$$\{[C_{B1} + rpC^{Q}_{E} + (1-r)pC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}\ ] + [D_{H} + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}\ ]\}.$$

Agreeing with the number given to the fixed numerical variables and $C^{NQ}_{E} = 574$, $D^{NQ}_{E} = 10$, and $n = 1.00$ the expected payoff is:

$$\{[3 + (0.95)(0.05)(20) + (0.05)(0.05)\mathbf{(574)} + (0.10)(0.95)(40) + (0.90)(0.95)(10)] + [35 + (0.95)(0.05)(220) + (0.05)(0.05)\mathbf{(10)} + (0.10)(0.95)(120) + (0.90)(0.95)(10)]\} = 83.16$$

which is the minimum expected payoff of the range 83.16-187.99 (see Table 10, page 96).

Figure 3 shows the damages and their combined strategies from the origin (0,0), for n = 1.00. We must remember

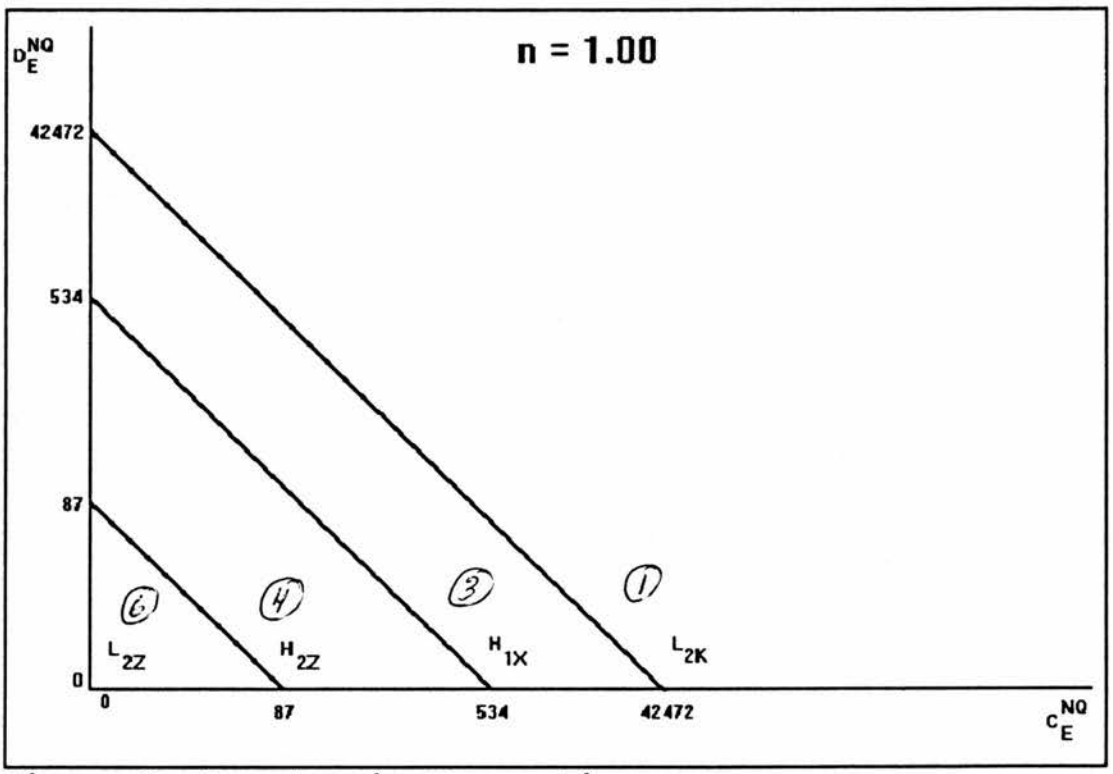


Figure 3 Symmetry in cooperative game

that the auditee and the auditor are assumed to have a 1:1 valuation on the transfer of money. Figure 3 pinpoints this symmetry (e.g., 87 is an intercept on both axes) when "n" does not influence the combined strategy. Figure 2 (page 97) shows the same selection but starting from (40,10) which are the minimum damages associated with an audit for the illustration used within this dissertation.

"n" is now changed from n = 1.00 to examine the effect on the pattern of changing "n". The end of the pattern happens at n = 0.96. Table 11 shows the combined strategies according to different damages for n = 0.96.

Table 11 Cooperative game n = 0.96

n = 0.96

Combined Strategy	Space intercepts: Auditor C^{NQ}_E	Auditee D^{NQ}_E	Expected pay-offs
L_{2K}	>42,512	>42,482	188.00
H_{1X}	574<<42,512	544<<42,482	83.16 - 187.99
H_{2Z}	127<<574	97<<544	60.85 - 83.15
L_{2Z}	40<<127	10<<97	30.50 - 60.60

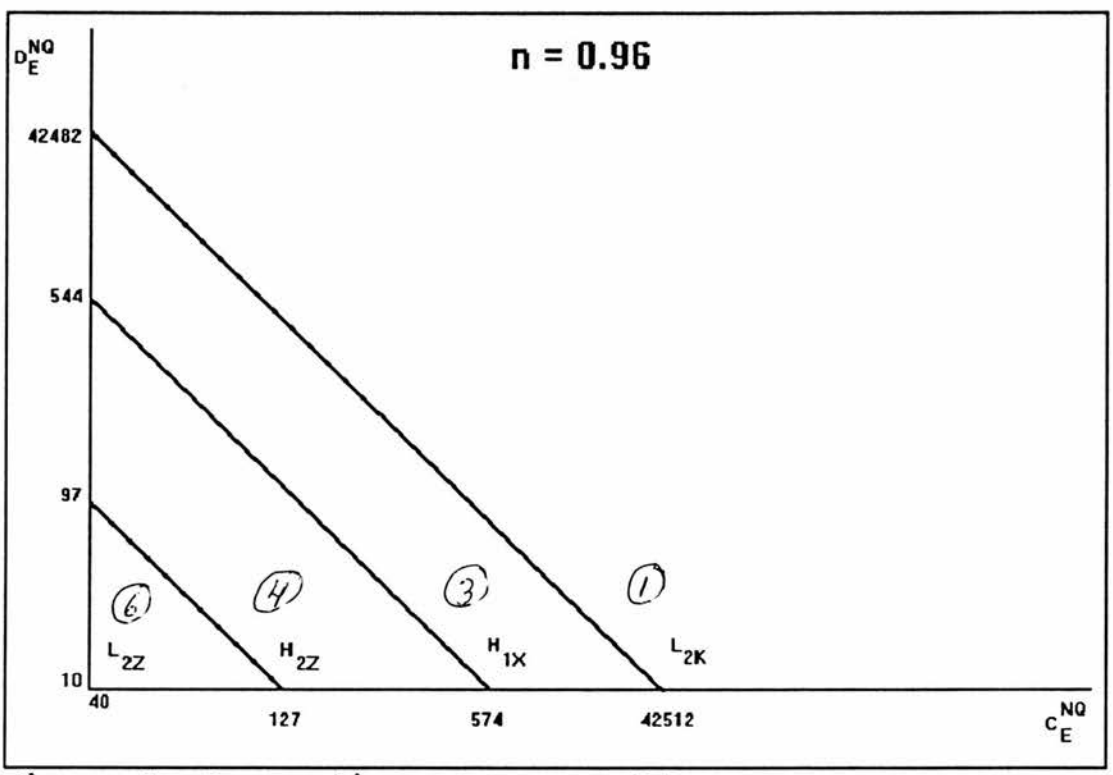


Figure 4 Cooperative game n = 0.96

Note that Table 10 and Table 11 are identical, except for the inducement "n". Also note that Figure 4 shows an

Table 12 Pattern One

1.00 >= n >= 0.96

Combined Strategy	Space intercepts: Auditor C^{NQ}_E	Auditee D^{NQ}_E	Expected pay-offs
L_{2K}	>42,512	>42,482	188.00
H_{1X}	574<<42,512	544<<42,482	83.16 - 187.99
H_{2Z}	127<<574	97<<544	60.85 - 83.15
L_{2Z}	40<<127	10<<97	30.50 - 60.60

identical pattern of strategies to Figure 2. In the range n = 1.00 to n = 0.96, the auditee and the auditor stick to the same strategies. Given that, Table 12 and Figure 5 show the result for the range n = 1.00 to n = 0.96. The other patterns are built in the same way.

Figure 5 shows schematically the strategies's space representing the pattern one for the range n = 1.00 to n = 0.96 and the relative damages commanding these strategies.

Pattern One

Table 12 and Figure 5 show that if society, through a regulator and/or court, imposes relative damages against

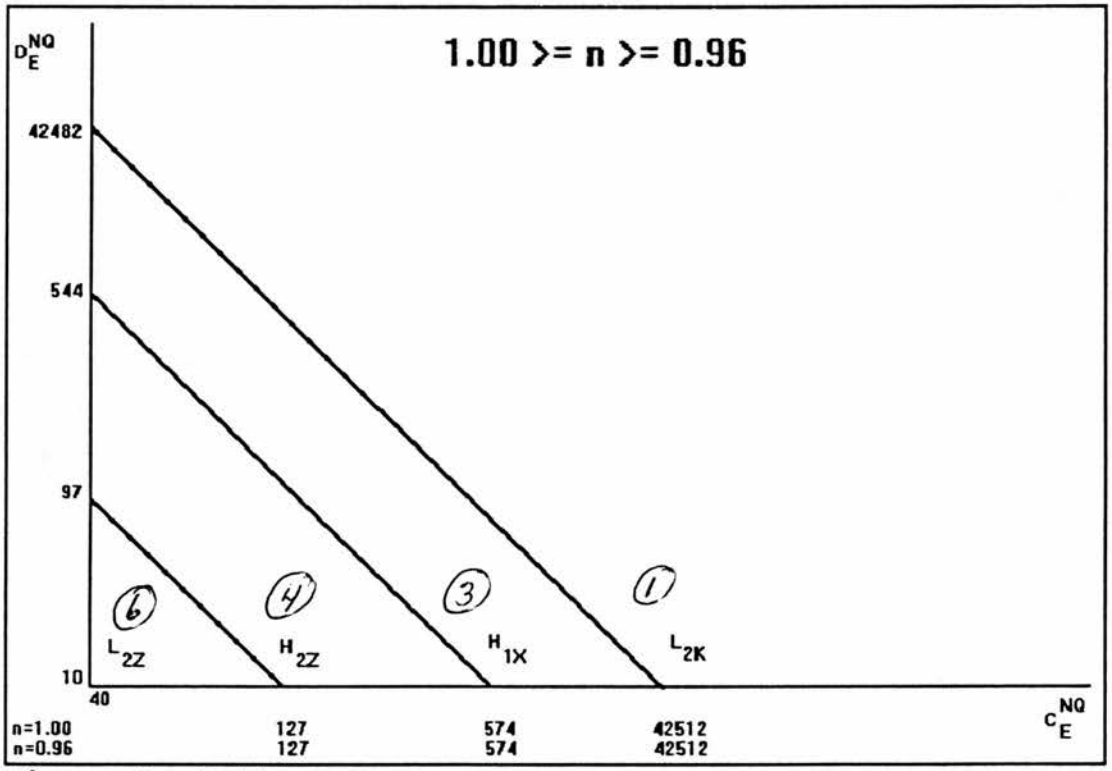


Figure 5 Pattern One

the auditee greater than 42,482 and the auditor greater than 42,512, then the auditee and the auditor choose the space identified 1 in Figure 5.

The combined strategy in space 1, L_{2k}, means that the auditee takes Low care, and that by choosing A_2 and B_2, the auditor does not incur extra direct costs. The auditor qualifies if B_2 signals a material error and also qualifies if B_2 does not signal a material error. In other words, his audit opinion is unconcerned with the result of the audit work within this space. The greatest amount of damages result in minimal required auditee care and minimum audit procedures. Both players, responding to this knowledge, choose a low level of effort since

effort is costly and produces minimal benefit in terms of damages. The highest damages level suggests that the auditee and the auditor give up in terms of effort.

The space identified 3 (H_{1X}) suggests that both the auditee and the auditor agree to higher effort and cost. The auditor chooses the extended test B_1 and his audit opinion relies on the test's signal. At the same time, the auditee works hard. Their efforts reduce the probability of material error being left in the financial statements.

The space identified 4 (H_{2Z}) suggests that only the auditee agrees to higher effort and cost. His effort reduces the probability of material error, although the auditor is still indifferent to the result of the audit work.

The space identified 6 (L_{2Z}) suggests that the auditee and the auditor agree to minimum effort. The auditee has chosen low level of care over the accounting system and the auditor does not qualify the audit report, no matter if a material error is found or not.

As shown in Figure 5 and Table 13, the auditee agrees to high level of care in spaces 3 and 4. This implies that

Table 13 Auditee strategies choices

1.00 >= n >= 0.96

Damages adopted by society	Figure space	Auditee's strategy	Auditee's effort
> 42,482	1	Low	
97-42,482	3 and 4	High	H
10-97	6	Low	

society could influence the auditee behaviour using different levels of damages and, although there is a need for damages, too high a level of damages (space 1 in Figure 5) is counterproductive.

If society adopts a policy towards the audit which encourages high effort by the auditees, then this implies the adoption of spaces 3 and 4 (H_{1x} and H_{2z}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E). A choice of damages from space 4 (H_{2z}) where the auditor does not qualify no matter if a material error is found or not, implies that society perceives the function of the audit as being not to find material error, but rather to induce the auditee to make higher effort and thus reduce the likelihood of material error.

Table 14 Pattern One: Auditor strategies choices

1.00 >= n >= 0.96

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 42,512	1	A_2, B_2: Q, Q	
574-42,512	3	A_2, B_1: Q,NQ	B_1
40-574	4 and 6	A_2, B_2:NQ,NQ	

Consequently, the inducement must be greater; meaning that "n" must be less than 0.96 to convince the auditor to choose test A_1. Mathematically, the reduction of damages to the percentage n = 0.96 payable on the total damages otherwise suffered by the auditor does not cover the fixed fees C_{A1} in any space within this pattern.

If society adopts a policy towards the audit which encourages qualification outcome dependent on the result of test B_1 by the auditor, then this implies the adoption of space 3 (H_{1X}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E).

If society adopts a policy towards the audit which encourages high effort by the auditees and qualification outcome dependent on the result of test B_1, then it is looking ideally for the parties to adopt the space 3 (H_{1X}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E).

The essential features of pattern one are:
1) society could influence the auditor's as well as the auditee's behaviour by adopting levels of damages towards the audit when there is non-qualification but material error;

2) commitments by the auditee to take a particular strategy when the auditor selects A_2 cannot be enforced because the auditee's strategy cannot be observed;
3) the audit opinion (qualified/non-qualified) cannot be contingent on the auditee's choice, since the auditor does not know (he does not play A_1) that choice.

Let us examine the effect of changing the range of "n" from 1.00 to 0.96 (pattern one) to 0.95 to 0.89 (pattern two).

Pattern Two

As previously stated in pattern one, none of the auditor strategies includes test A_1, the test which reveals to the auditor the auditee strategy. To encourage the inclusion of test A_1 (qualitative test) in the auditor's strategy, it is necessary to offer an incentive in the form of a percentage less than 0.96 ($n < 0.96$) payable on the total damages otherwise suffered by the auditor in the event of a failure to qualify a materially inaccurate set of financial statements.

Figure 6 shows schematically the pattern of strategies associated with the range n = 0.95 to 0.89. The only change in Figure 6 from Figure 5 (page 103) happens in

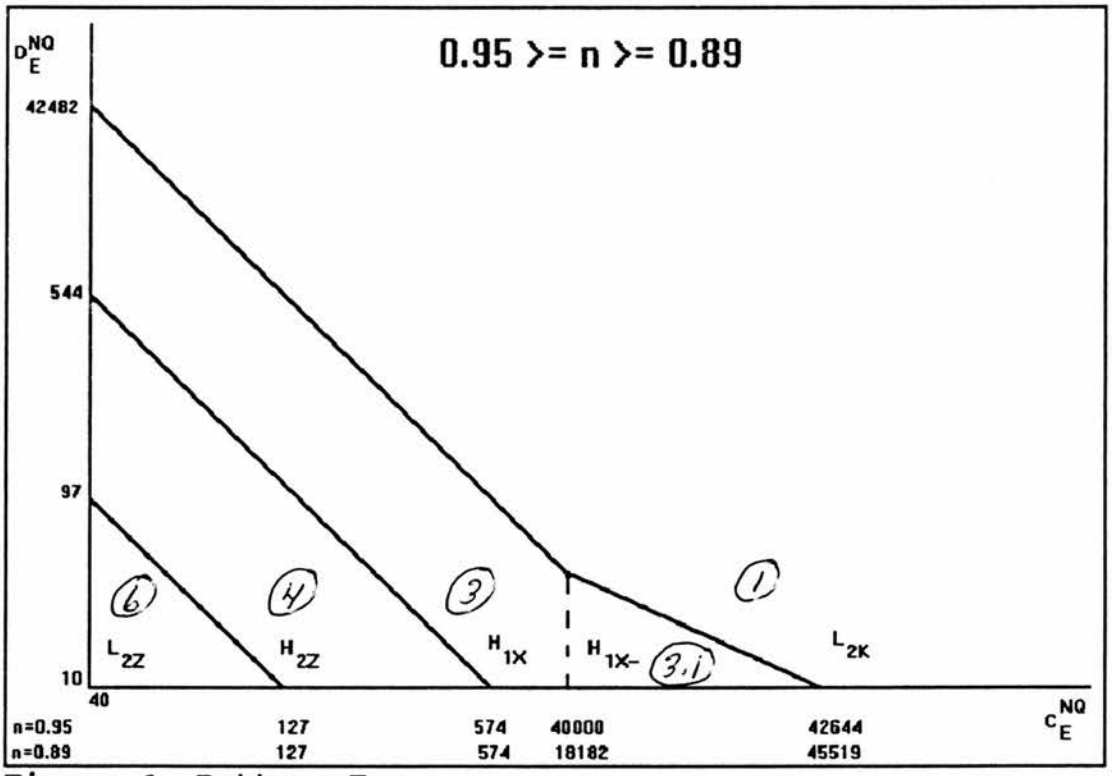


Figure 6 Pattern Two

space 3 (H_{1X}). There is one new space and that is 3.1. This space is an extension of space 3. It has the same strategy root H_{1X}. The other spaces are identical to pattern one.

The strategy of space 3.1 (H_{1X--}) suggests that the auditor agrees to employ tests A_1 and B_1. We must remember that the presence of a dash within a subscript means the auditor has chosen A_1. The auditor performs the most rigorous audit, which includes observation of the auditee strategy (A_1) and the extended test (B_1), and his audit opinion relies on his observation of commitments by the auditee and the test's signal. Hence the fixed fee of test A_1, C_{A1} has been covered at the starting range n =

0.95.

To calculate the damages limit, C^{NQ}_E, the cost of H_{1X} is set equal to H_{1X-} and by elimination we obtain:

$$(1-r)pC^{NQ}_E = C_{A1} + (1-r)pnC^{NQ}_E \quad (1)$$

and the lower limit is obtained by isolating C_{A1} from the equation (1) and solving for C^{NQ}_E:

$$C^{NQ}_E = C_{A1}/(1-n)(1-r)p \quad (2)$$

and the upper limit, as shown in Figure 3 for n = 1.00, must equal 42,512, the maximum damages before the auditor gives up and qualifies no matter if a material error is found or not. So putting 42,512 in equation (1), we obtain:

$$(1-r)p(42,512) = C_{A1} + (1-r)pnC^{NQ}_E \quad (3)$$

isolating nC^{NQ}_E from the equation (3) and solving for C^{NQ}_E:

$$C^{NQ}_E = \{[(42,512) - C_{A1}/(1-r)p]/n\} \quad (4)$$

For example, in Figure 6, for n = 0.95, C_{A1} = 5, p = 0.05 and r = 0.95, the lower limit is 5/(0.05)(0.05)(0.05) = 40,000; and the upper is {[42,512 -

5/(0.05)(0.05)]/(0.95)} = 42,644.

Table 15 Pattern Two: Auditor strategies choices

0.95 >= n >= 0.89

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 42,644; 45,519	1	A_2, B_2: Q, Q	
40,000-42,644; 18,182-45,519	3.1	A_1, B_1: Q,NQ	A_1 and B_1
574-40,000; 574-18,182	3	A_2, B_1: Q,NQ	B_1
40-574	4 and 6	A_2, B_2:NQ,NQ	

As shown in Figure 6 and Table 15, the auditor's high efforts are A_1 and B_1, and B_1. As regards the auditor's highest effort, one of his strategies corresponding to space 3.1 (H_{1X--}) in Figure 6 includes the test revealing the auditee's strategy A_1 and the extended test B_1; hence the most rigorous audit work is within that space.

If society adopts a policy towards the audit which encourages auditors to employ test A_1, then this implies the adoption of space 3.1 (H_{1X--}) for the selection of damages associated with a non-qualified opinion (NQ) when

the state of accounting information is in error (E).

If society adopts a policy towards the audit which encourages high effort by the auditee and selection of test A_1 and qualification outcome dependent on the result of test B_1, then it is looking ideally for the adoption of the space 3.1 ($H_{1X..}$).

The essential feature of pattern two is that society could influence the auditor in such a way that he employs the test A_1 which reveals the auditee's strategy and confines his audit opinion to the signal from the extended test B_1.

Let us examine the effect of changing the range of "n" from 0.95 to 0.89 (pattern two) to 0.88 to 0.83 (pattern three).

Pattern Three

Figure 7 shows schematically the pattern of strategies associated with the range n = 0.88 to n = 0.83. The only change in Figure 7 from Figure 6 happens in space 6 (L_{22}). There is one new space that is 6.1. This space is an extension from space 6. The strategy of space 6.1 has the same root (L_{22}) as space 6. The other spaces are

identical to pattern two.

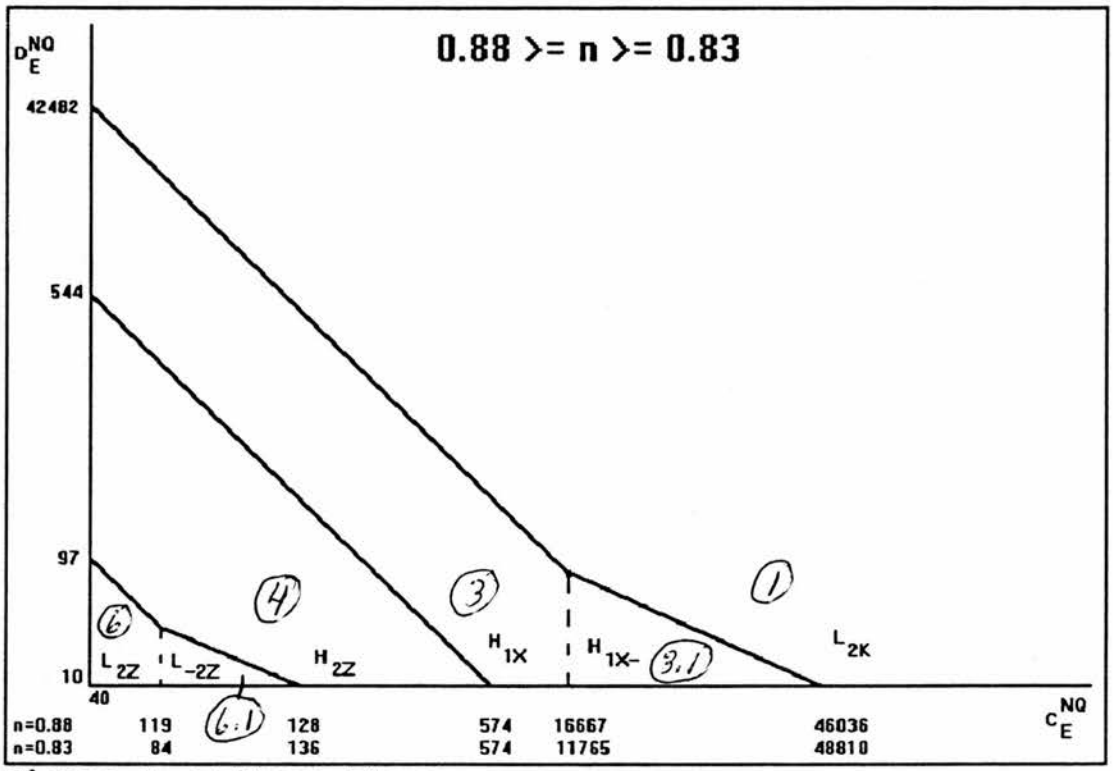


Figure 7 Pattern Three

The strategy of space 6.1 (L_{-2Z}) indicates that the auditor agrees to employ test A_1 which reveals to him the auditee strategy. He plays test A_1 purely to observe the auditee's strategy by getting a lower percentage (n) on the total damages that would otherwise be incurred, since commitment by the auditee to choose low level of care is the worst possibility that a material error could occur and the auditor does not qualify no matter if a material error is found or not.

Table 16 Pattern Three: Auditor strategies choices

0.88 >= n >= 0.83

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 46,036; 48,810	1	A_2, B_2: Q, Q	
16,667-46,036; 11,765-48,810	3.1	A_1, B_1: Q,NQ	A_1 and B_1
574-16,667; 574-11,765	3	A_2, B_1: Q,NQ	B_1
119-128; 84-136	6.1	A_1, B_2:NQ,NQ	A_1
40-119; 128-574; 40-84; 136-574	4 and 6	A_2, B_2:NQ,NQ	

As shown in Figure 7 and Table 16, the auditor's high efforts are A_1 and B_1, B_1, and A_1. As regards the auditor's highest effort, one of his strategies (Table 16) corresponding to space 3.1 (H_{1X--}) in Figure 7 includes the test revealing the auditee's strategy (A_1) and the extended test (B_1); hence the most rigorous audit work is within that space.

If society adopts a policy towards the audit which encourages auditors to employ test A_1, then this implies the adoption of space 3.1 (H_{1X--}) and 6.1 (L_{--2Z}). But a choice of damages from space 6.1 where the auditee has

chosen low level of care and the auditor employs the test A_1 only to get a lower "n" and does not qualify no matter if a material error is found or not, implies that society perceives the function of the audit as being not to find material error but to reveal the auditee strategy. Therefore, the auditor is playing the system; that is, he is getting the benefit of playing test A_1 but not performing to the spirit.

The essential feature of pattern three within space 6.1 implies that the choice of this level of society's inducement is not worth it for society; as it benefits only the auditor who performs test A_1.

Let us examine the effect of changing the range of "n" from 0.88 to 0.83 (pattern three) to 0.82 to 0.65 (pattern four).

Pattern Four

Figure 8 shows schematically the pattern of strategies associated with the range n = 0.82 to n = 0.65. The only change in Figure 8 from Figure 7 page 114 happens in space 4 (H_{2Z}). There is one new space that is 4.1. This space is an extension from space 4. It has the same strategy root H_{2Z}. The other spaces are identical to

pattern three.

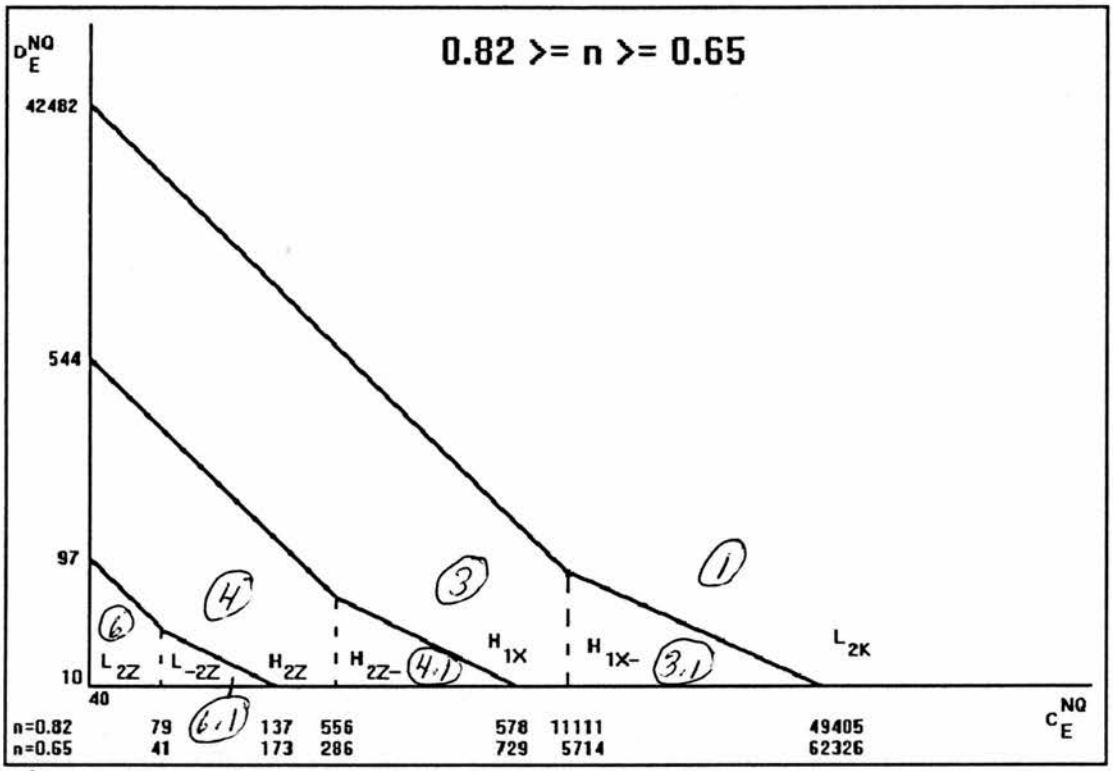


Figure 8 Pattern Four

The strategy of space 4.1 (H_{2Z--}) indicates that the auditor agrees to employ test A_1 which reveals the auditee's strategy. Although he looks at the auditee's strategy in that space, his audit opinion, as in pattern three, is indifferent to the results of the audit work.

As shown in Figure 8 and Table 17, the auditor's high efforts are A_1 and B_1, B_1, and A_1. As regards the auditor's highest effort, one of the auditor's strategies (Table 17) corresponding to space 3.1 includes the test revealing the auditee's strategy A_1 and the extended test B_1; hence the most rigorous audit work is within that

Table 17 Pattern Four: Auditor strategies choices

0.82 >= n >= 0.65

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 49,405; 63,226	1	A_2, B_2: Q, Q	
11,111-49,405; 5,714-62,326	3.1	A_1, B_1: Q,NQ	A_1 and B_1
578-11,111; 729-5,714	3	A_2, B_1: Q,NQ	B_1
79-137; 556-578; 41-173; 286-729	4.1 and 6.1	A_1, B_2:NQ,NQ	A_1
40-79; 137-556; 40-41; 173-286	4 and 6	A_2, B_2:NQ,NQ	

space.

If society adopts a policy towards the audit which encourages auditors to employ test A_1, then this implies the adoption of spaces 3.1 (H_{1X--}), 4.1 (H_{2Z--}) and 6.1 (L_{--2Z}). A choice of damages from space 4.1 where the auditor does not qualify no matter if a material error is found or not, implies that society perceives the function of the audit as being not to find material error but rather to enforce commitment by the auditee to choose high level of care and thus reduce the likelihood of material error. But the auditor in these spaces, except space 3.1, plays

test A_1 only to reveal the auditee's strategy by earning a lower percentage offered on C^{NQ}_E.

The essential feature of pattern four within space 4.1 is that society may influence the auditor to employ test A_1 to induce the auditee to select high effort.

Let us examine the effect of changing the range of "n" from 0.82 to 0.65 (pattern four) to 0.64 to 0.56 (pattern five).

Pattern Five

Figure 9 shows schematically the pattern of strategies associated with n = 0.64 to n = 0.56. The only change in Figure 9 from Figure 8 happens in space 6.1 (L_{--2Z}). There is one less space and that space is space 6. The other spaces are identical to pattern four.

The elimination of space 6 (L_{2Z}) suggests that the auditor employs test A_1 which reveals to him the auditee strategy within the space. Although he looks at the auditee strategy in that space, his audit opinion, as in pattern three, is indifferent to the results of the audit work. Nor is test A_1 being played to induce high effort as in pattern four. In this space, test A_1 is being played to

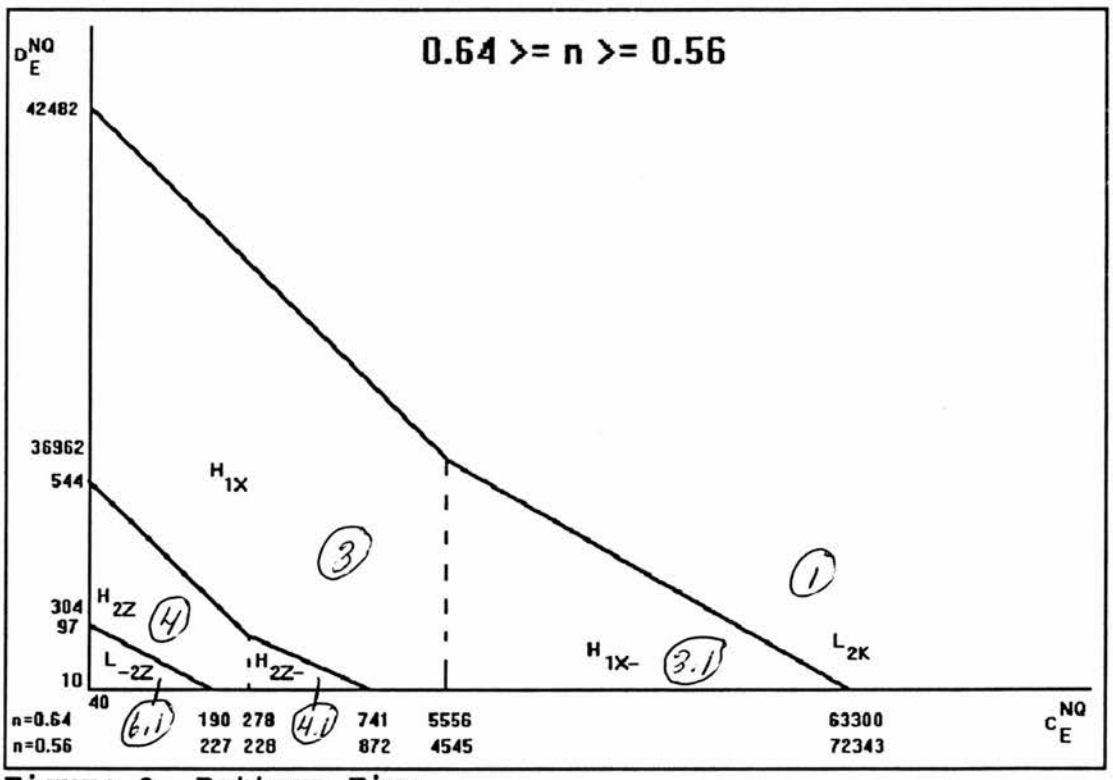


Figure 9 Pattern Five

observe the auditee's strategy.

As shown in Figure 9 and Table 18, the auditor's high efforts are A_1 and B_1, B_1, and A_1. As regards the auditor's highest effort, one of the auditor's strategies (Table 18) corresponding to space 3.1 in Figure 9 includes the test revealing the auditee's strategy A_1 and the extended test B_1; hence the most rigorous audit work is within that space.

If society adopts a policy towards the audit which encourages auditors to employ test A_1, then this implies the adoption of spaces 3.1 (H_{1X--}), 4.1 (H_{2Z--}) and 6.1 (L_{--2Z}).

Table 18 Pattern Five: Auditor strategies choices

0.64 >= n >= 0.56

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 63,300; 72,343	1	A_2, B_2: Q, Q	
5,556-63,300; 4,545-72,343	3.1	A_1, B_1: Q,NQ	A_1 and B_1
741-5,556; 872-4,545	3	A_2, B_1: Q,NQ	B_1
190-278; 227-228	4	A_2, B_2:NQ,NQ	
40-190; 40-227 278-741; 228-872	4.1 and 6.1	A_1, B_2:NQ,NQ	A_1

An essential feature of pattern five within space 6.1 ($L_{..}$ $_{zz}$) is that the result of society inducement is not necessarily perfect since after the information has been revealed the auditor may prefer to cancel any audit work to avoid auditing cost. If society, however, recognizes that the auditing effort may not be done or be worth while in that space, it should not agree to any inducement effects of test A_1 within that space.

Let us examine the effect of changing the range of "n" from 0.64 to 0.56 (pattern five) to 0.55 to 0.23 (pattern six).

Pattern Six

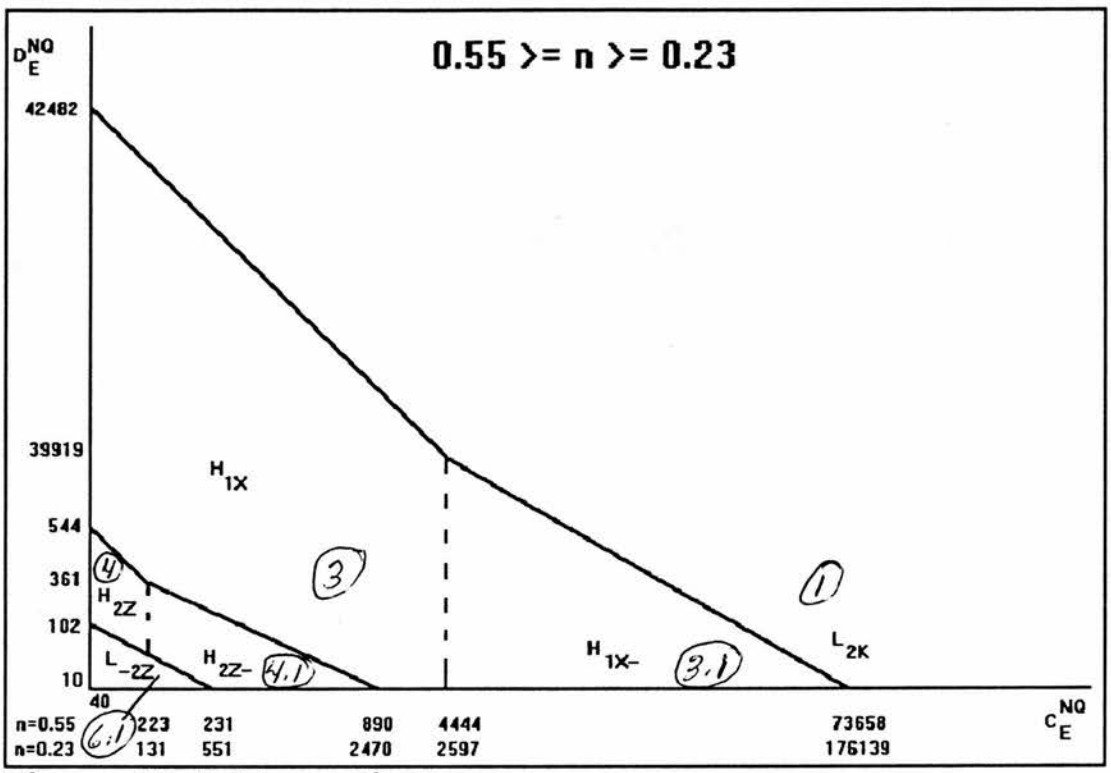


Figure 10 Pattern Six

Figure 10 shows schematically the pattern of strategies associated with n = 0.55 to n = 0.23. The only change in Figure 10 from Figure 9 happens to the placement of space 4.1 (H_{2Z--}). The implication is that certain strategic choices cannot be induced by damages on the auditor alone; hence, space 4 (H_{2Z}) does not lie on the x axis. The other spaces are identical to pattern five.

The strategy of space 4.1 (H_{2Z--}) suggests that the auditor employs test A_1 which reveals to him the auditee strategy

within the space. Although he looks at the auditee strategy in that space, his audit opinion, as in pattern four, is indifferent to the results of the audit work and he plays test A_1 only to reveal the auditee's strategy by earning a lower percentage offered on C^{NQ}_{E}.

Table 19 Pattern Six: Auditor strategies choices

0.55 >= n >= 0.23

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 73,658; 176,139	1	A_2, B_2: Q, Q	
4,444-73,658; 2,597-176,139	3.1	A_1, B_1: Q,NQ	A_1 and B_1
890-4,444; 2,470-2,597	3	A_2, B_1: Q,NQ	B_1
40-890; 40-2,470	4.1 and 6.1	A_1, B_2:NQ,NQ	A_1

As shown in Figure 10 and Table 19, the auditor's efforts are A_1 and B_1, B_1 and A_1. As regards the auditor's highest effort, one of the four auditor's strategies corresponding to space 3.1 in Figure 10 includes the test revealing the auditee's strategy A_1 and the extended test B_1; hence the most rigorous audit work is within that space.

If society adopts a policy towards the audit which encourages auditors to employ test A_1, then this implies the adoption of spaces 3.1 ($H_{1x..}$), 4.1 ($H_{2z..}$) and 6.1 ($L_{..2z}$).

The essential features of pattern six is that, in certain strategic choices, space 4 (H_{2z}) can not be induced by damages on the auditor alone and within space 4.1 ($H_{2z..}$) this level of society inducement does not influence the audit opinion, but does induce the auditee to high effort. The inducement is not necessarily perfect since after the information has been revealed the qualification outcome is independent from the result of test B and the auditor may prefer to cancel any extra audit work to avoid auditing cost. If society, however, recognizes that the test A_1 may influence the auditee to choose high effort, the inducement effects of test A_1 in space 4.1 could be worthwhile.

Let us examine the effect of changing the range of "n" from 0.55 to 0.23 (pattern six) to "n" less than 0.23 (pattern seven).

Pattern Seven

Figure 11 shows schematically the pattern of strategies

associated with "n" less than 0.23. From n <= 0.22, the auditor has agreed to select test A_1 within all spaces except space 1 (L_{2K}). Figure 12 shows schematically the pattern of strategies associated with "n" equal to 0.01, the greatest inducement before society gives up any damages in cases where the auditor plays A_1.

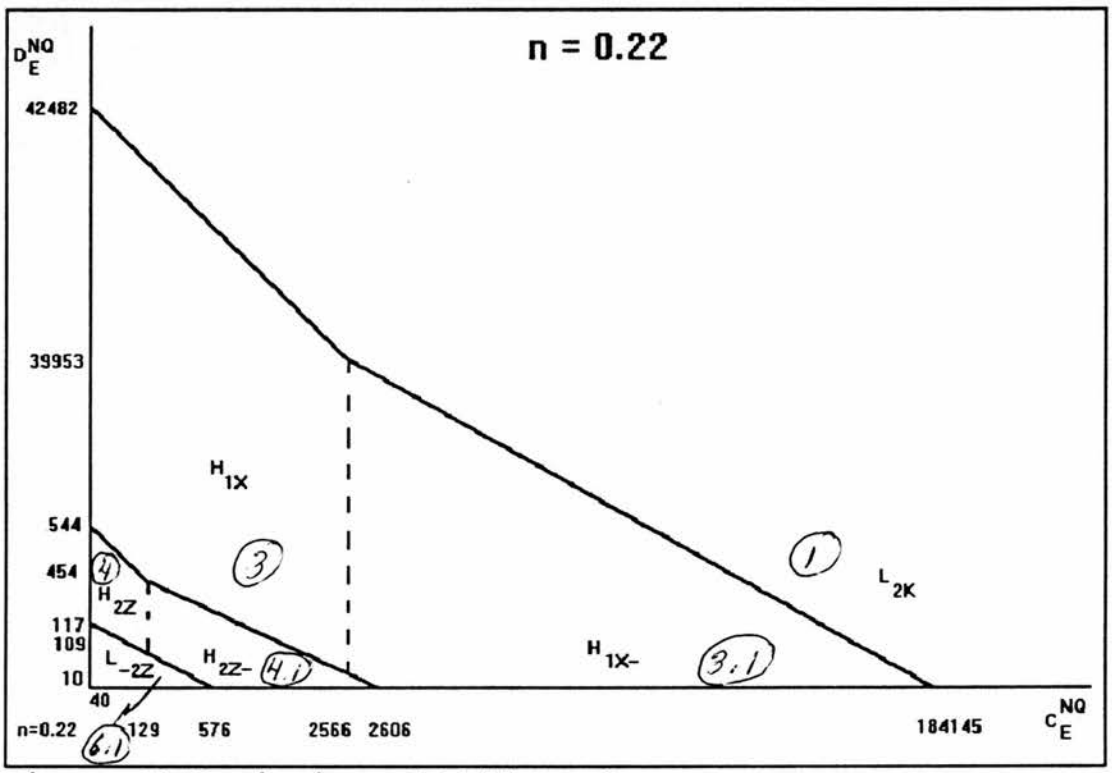


Figure 11 Beginning of Pattern Seven

The only change in Figure 11 and Figure 12 from Figure 10 happens in space 3.1 (H_{1X--}). Space 3 is removed from the x axis. The other spaces are identical to pattern six. The implication is that in certain strategic choices, space 4 (H_{2Z}) and 3 (H_{1X}), cannot be induced by damages on the auditor alone.

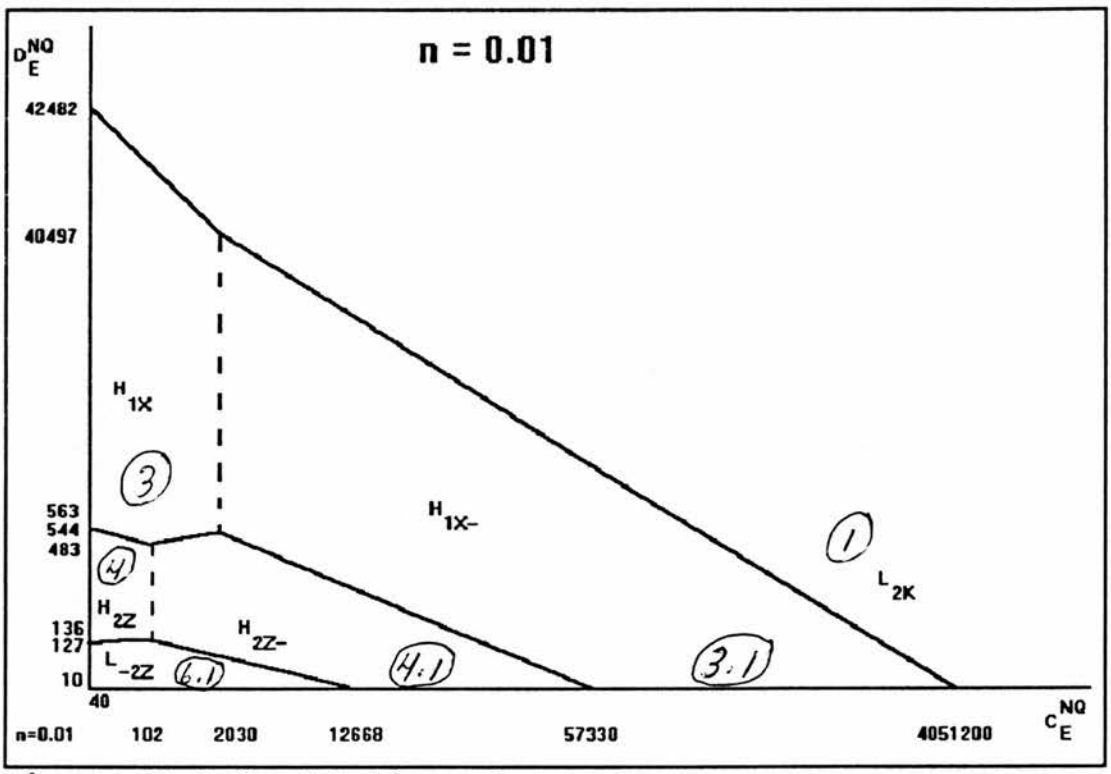


Figure 12 End of Pattern Seven

Space 3.1 on the x axis is only represented by H_{1X--}. On the x axis the auditor employs test A_1 which reveals to him the auditee strategy within all spaces but space 1 (L_{2K}). However, he looks at the auditee strategy in space 3.1 (H_{1X--}), his audit opinion is dependent on the results of the audit work.

As shown in Figure 11, Figure 12 and Table 20, the auditor's high efforts are A_1 and B_1, and B_1. As regards the auditor's highest effort, one of the three auditor's strategies (Table 20) corresponding to space 3.1 in Figure 11 includes the test revealing the auditee's strategy A_1 and the extended test B_1; hence the most rigorous audit work is within that space.

Table 20 Pattern Seven: Auditor strategies choices

0.22 >= n >= 0.01

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
> 184,145; 4,051,200	1	A_2, B_2: Q, Q	
2,606-184,145; 57,330-4,051,200	3.1	A_1, B_1: Q,NQ	A_1 and B_1
40-2,606; 40-57,330	6.1	A_1, B_2:NQ,NQ	A_1

If society adopts a policy towards the audit which encourages the auditee to make high effort and selection of test A_1 and qualification outcome dependent on the result of test B_1 by the auditor, then it is looking ideally for the adoption of the space 3.1 ($H_{1x..}$).

The essential feature of pattern seven is that society could encourage the auditor to employ test A_1 and know the auditee's strategy through all spaces except space 1 (L_{2k}) with n = 0.22 or less by imposing damages on the auditor.

Summary

The following sums up the possible attitudes of society towards the patterns chosen by the auditee and the auditor.

If society adopts a policy towards the audit which encourages high effort by the auditees, then this implies the adoption of spaces 3 (H_{1X}) and 4 (H_{2Z}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E). The relative damages are approximately identical through all the patterns.

If society adopts a policy towards the audit which encourages qualification outcome dependent on the result of test B_1 by the auditor, then this implies the adoption of space 3 (H_{1X}). Note that this space is in all patterns although from pattern seven it implies that society cannot induce this strategic choice by damages on the auditor alone.

It should be remembered that a choice of damages from space 4 (H_{2Z}), where the auditor does not qualify no matter if a material error is found or not, implies that society perceives the function of the audit as being not to find material error, but rather to induce higher effort on the part of the auditee and thus reduce the likelihood of material error.

If society adopts a policy towards the audit which encourages auditors to employ test A_1, this implies the adoption of space 3.1 ($H_{1X\cdot\cdot}$) starting from pattern Two,

6.1 (L_{--2Z}) starting from pattern Three, and 4.1 (H_{2Z--}) starting from pattern Four. However, a choice of damages from space 4.1 and 6.1 where the auditor employs the test A_1 and does not qualify no matter if a material error is found or not, implies that society's incentive may induce the auditor to play test A_1; that is, to reveal the auditee strategy but to employ bad logic from there on.

If society adopts a policy towards the audit which encourages the auditee to make high effort and selection of test A_1 and qualification outcome dependent on the result of test B_1 then it is looking ideally for the adoption of the space 3.1 (H_{1X--}) starting from pattern Two.

The essential feature of all the patterns is that society could influence the auditee and the auditor behaviour by selecting different damages.

Conclusion

This chapter has explored, through a cooperative game theory of the audit, how the auditee's and the auditor's strategic choices are influenced by damages imposed on auditee and auditor for issuing a materially inaccurate set of statements without a qualified audit opinion. It

is seen that these damages must be established within a specific range of "n" and spaces, the choice of "n" and spaces being dependent upon the policy objectives of society.

Possible policy objectives considered are: (1) to induce the auditee to make high effort; (2) to induce the auditor to select a qualification outcome dependent on the result of test B; (3) to induce the auditor to employ test A_1; and (4) to induce the auditee to make high effort and induce the auditor to employ test A_1, and a qualification outcome dependent on the result of test B through the behavioural effect of the audit.

In considering the policy objective (1), it may not be necessary for the auditor to maximize effort. This implies that society perceives the function of the audit as being not necessarily to find material error, but rather to induce higher effort on the part of the auditee and thus reduce the likelihood of material error. It could achieve this by promoting auditee relative damages within spaces 3 and 4 of each pattern.

In considering the policy objective (2), society should set auditor relative damages within space 3 (H_{1X}) of patterns except within pattern seven where it cannot be induced by damages on the auditor only. This implies

that society perceives the function of the audit as being necessarily to find material error.

In considering the policy objective (3), society must offer an inducement in the form of a proportion of the damages suffered by the auditor in the event of a failure to qualify a materially inaccurate set of statements. This implies that society perceives the function of the audit as being necessarily to reveal the auditee's strategy (see space 3.1 ($H_{1X..}$), 4.1 ($H_{2Z..}$) and 6.1 ($L_{..2Z}$)), and induce high effort from the auditee within space 4.1 and 3.1. However, within space 4.1 and 6.1 the auditor qualification outcome is independent of the result of test A_1 and society should not encourage this space.

The policy objective (4) which has been considered combines the three first possible policy objectives. This implies that society perceives the function of the audit as being necessarily to induce higher effort on the part of the auditee, to employ test A_1 and qualification outcome contingent on the result of test B_1 on the part of the auditor. Only the space 3.1 ($H_{1X..}$) starting from pattern Two meets this audit function. Note that pattern Two has an inducement of only $0.95 >= n >= 0.89$, meaning that society gives up only between five and eleven percent of the total damages otherwise suffered by the auditor in the event of a failure to qualify a materially

inaccurate set of statements. A choice of this space and "n" is the cheapest option for society to get high effort from the auditee as well as the most rigorous audit.

The combination of the policy (1) and (2) let us know that if society adopts a policy towards the audit which encourages high effort by the auditees and qualification outcome dependent on the result of test B_1, then it is looking ideally for the parties to adopt the space 3 (H_{1X}). Note that this space is in all patterns and the cheapest pattern in terms of inducement for society is pattern One.

In this chapter the audit is modelled as a cooperative game, and in the first pattern of this cooperative game ($1.00 >= n >= 0.96$) there is an element of trust since the auditor does not play test A_1 to check that the auditee is carrying out the agreed auditee strategy.

It is seen that society inducement "n" modifies firstly space 3 (H_{1X}, pattern two), secondly space 6 (L_{2Z}, pattern three), and thirdly space 4 (H_{2Z}, pattern four). Finally, the inducement "n" extends fully the use of test A_1 respectively to space 6.1 (pattern five), space 4.1 (pattern six), and finally 3.1 (pattern seven). Thus for $n = 0.22$ or less, the auditor always chooses the test A_1 which reveals the auditee's strategy, except for space

one, assuming the inducement of damages is available for the auditor alone.

It is also seen that the auditor performs an audit opinion contingent on the signal of test B (space 3 and 3.1) only when he selects test B_1. In all other spaces, the auditor is indifferent to the test B result and qualifies within space 1 and does not qualify in the other spaces (4, 4.1, 6 and 6.1).

The patterns of this cooperative game show that under a policy objective of maximising auditee and auditor effort, setting the damages too high or too low results in the auditee adopting a low level of care and the auditor adopting a dominant strategy with the audit opinion (qualified or non-qualified) being indifferent to the results of the audit. There is a need for damages, but extreme damages levels are counterproductive.

The next chapter examines different patterns of the non-cooperative game.

NON-COOPERATIVE GAMES

Rubinstein (1990) says, the "non-cooperative theory requires that there be neither commitment nor contracting power, but it permits communication; and it is concerned with equilibrium outcomes." (p.106). Thus, non-cooperative games are games with strictly opposite interests (zero-sum game) and games with mixed interests without enforceable agreements. The crucial feature is the inability to make a binding agreement; hence, each player seeks a strategy to minimize his own expected cost (payoff) based on the anticipated behaviour of the other player. They would both prefer to cooperate if they could, but their preferences, which differ from those indicated in the last chapter, are such that it is rational for them not to cooperate.

The interest in this illustration is in a non-cooperative setting in which the auditee and the auditor have mixed interests without enforceable agreements. This captures the major elements of the standard external audit settings, in which there are objectives of mutual interest (e.g., uncovering of unintended accounting error) and points of conflict (e.g., auditee's effort to reduce reporting errors and auditor's divulgence of auditee's strategy) between the auditee and the auditor.

For example, Aldersley (1989) argues that the auditee's view of materiality is substantially different from audit materiality and auditees require much more extensive procedures before even considering a correction.

Kinney (1988) cites Beaver and Demski who argue that audited financial statements have two primary uses: one is the pre-decision use of providing information about the state of the firm, and the second is a post-decision use of facilitating contracting with respect to the state of the firm; in both cases, the statement's preparer generally has a conflict of interest with the user.

The illustration of the influence of cost on the strategic choice of auditor/auditee discusses the implications of policy objectives presented in the previous chapter (page 92, 130) for each variation of four different "patterns" revealed by the non-cooperative game. Implications of these alternatives are then discussed for the overall four different "patterns". Subsequently, two patterns of the previous chapter (cooperative game) and two of this chapter (non-cooperative game) are overlapped.

The remainder of this chapter is organized as follows: in the next section, the meaning of "pattern" is defined and its building is demonstrated; in the following

sections, the four different and two overlapped patterns are presented; the conclusion is contained in the final section.

Meaning and building of pattern

As in the previous chapter, a pattern shows a picture (e.g., pattern one, Figure 15, page 149) of the spaces occupied by the same joint strategies in response to the effects of three variables. The first variable is the amount of damages for the auditor associated with the combination of non-qualified opinion and materially inaccurate statements, C^{NQ}_{E}, and this lies on the x axis. The second variable is the amount of damages for the auditee associated with the combination of non-qualified opinion and materially inaccurate statements, D^{NQ}_{E}, and this lies on the Y axis. Lastly, there is the range of inducement for the auditor to employ test A_1, "n", in order to reveal the auditee strategy. The value of "n" is shown at the centre of the top of the pattern. The effect of varying "n" affects only the variable C^{NQ}_{E} (x axis). Let us look at how we choose the joint strategies.

Choice of the joint strategies

We use, as explained in the preceding chapter (page 94), different extension numbers of Table from .1 to .5. The joint strategies are obtained from the payoff values.

Appendix A.2 (page 215), shows the payoffs in the game where $C^{NQ}_E = 40$, $D^{NQ}_E = 10$ and n = 1.00. Under the "Non-Coop" title, the minimum payoff for the auditor for each of his possible strategies is given when the auditee plays H and then when the auditee plays L. The "MINIMUM" line shows the auditor's minimum payoff of the game against each of the auditee's strategy, and indicates where to find it.

Nash's theorem tells us that there is always at least one equilibrium pair in a finite game. In games with minimizing objectives, like the ones considered here, (x,y) is an equilibrium pair if $e_1(x',y) \Rightarrow e_1(x,y)$, where $e_1(.,.)$ is the auditor's payoff and $e_2(.,.)$ is the auditee's payoff. Thomas (1984) specifies that if for any y we find the x that minimizes $e_1(x,y)$ and, if that y is part of an equilibrium pair, then we have found the x that must be its partner.

For our game this implies that if (x^*,H) is an equilibrium pair, the x^* must be the minimum of $e_1(x,H)$; and if (x^*,L) is an equilibrium pair, $e_1(x,L)$ must be minimized at x^*.

For example, Appendix A.4 (page 223), shows the extract of payoffs of the possible strategies within this game for C^{NQ}_E = 144, D^{NQ}_E = 10 and n = 1.00. The auditor's minimum payoff for the non-cooperative game, if the auditee plays his strategies H, is 16.66, that is, $e_1(x^*,H)$ = 16.66, meaning that $x^* = s_{1X}$; if the auditee plays L, it is 20.62, that is, $e_1(x^*,L)$ = 20.62, meaning that $x^* = s_{1X}$; and because $e_2(s_{1X},H) <= e_2(s_{2Z},L)$, we have an equilibrium pair (s_{1X},H).

However, the equilibrium pair could be a mixture of pairs of strategies; for example, Appendix A.2 (page 215), shows the payoffs of the possible strategies within this game for C^{NQ}_E = 40, D^{NQ}_E = 10 and n = 1.00. The auditor's payoff for the non-cooperative game if the auditee plays his strategy H, is 11.50, that is, $e_1(x^*,H)$= 11.5, meaning that $x^* = s_{2Z}$, but $e_2(s_{2Z},H)$ is not less than or equal to $e_2(s_{2Z},L)$. The auditor's minimum payoff, if the auditee plays L, is 18.80, that is, $e_1(x^*,L)$= 18.80, meaning that $x^* = s_{1X}$, but $e_2(s_{1X},L)$ is not less than or equal to $e_2(s_{1X},H)$. Therefore, there is a mixture (see Thomas (1984)), that is, x^* is a mixture of s_{2Z}, s_{1X}, and y^* is a mixture of H, L; hence, for the joint strategies (s_{2Z}, H) the payoff is (11.50, 45.00) (auditor, auditee); for (s_{2Z}, L) it is (20.50, 10.00); for (s_{1X}, H) it is (16.40, 65.43); and for (s_{1X}, L) it is (18.80, 86.98), of playing each.

To find the limits of the joint strategy, we change the auditor's amount of damages on the x axis until the actual joint strategy shifts to another joint strategy. Appendix A.4 (page 222), with an extract of Table 4 and 5 shows how it works; for example, the minimum payoffs for C^{NQ}_{E} = 143, the auditor's damages on the x axis, identified in Table 4, are 16.65 and 20.60, which point out the randomized joint strategy $R_{R(2Z,1X)}$, the same strategies as in Table 1 (see appendix A.2, page 215); however, the minimum payoffs for C^{NQ}_{E} = 144, the auditor's damages on the x axis, identified in Table 5, are 16.66 and 20.62, which point out the joint pure strategy H_{1X}. There is only one pure strategy because the minimum cost pair (16.66, 65.43) is less than the minimum cost pair (20.62, 86.98). Given their motivation to minimize cost, no one would like to, unilaterally, change his strategy. We do the same process for the auditee's damages on the y axis. Let us look at pattern one as an illustration of pattern building.

Building pattern one

The "solution" we take in a non-cooperative game is the Nash equilibrium. The first example sets n = 1.00 meaning society does not recognize the auditor's effort when he has chosen test A_1 which reveals to him the

auditee's strategy. Remember that the minimum damages regime has damages C^{NQ}_E >= 40 and D^{NQ}_E >=10; that is, the minimum damages. Table 21 shows the joint strategies in a non-cooperative game for various damages regime (C^{NQ}_E, D^{NQ}_E).

Table 21 Non-Cooperative game n = 1.00

n = 1.00

Joint Strategy	C^{NQ}_E Space	D^{NQ}_E Space	H Auditor, and Auditee payoff	L Auditor, and Auditee payoff
L_{2K}	>9082	>10	39.00, 160.00	**33.00, 155.00**
H_{1X}	852<< 9082	>10	**18.43-38.99, 65.43- ***	33.01-176.95, 86.98- *
L_{2K}			39.00, 160.00	**33.00, 155.00**
R			**Randomized**	
H_{1X}	144<<852	>10	**16.66-18.43, 65.43- ***	20.62-32.99, 86.98- *
H_{2Z}	40<<144	>127	**11.50-16.65, 50.85- ***	20.50-56.55, 50.95- *
$R_{R(2Z,1X)}$	40<<144	10<<127	11.50-16.65, 45.00-50.80	20.50-56.55, 10.00-50.60
			Randomized	
			16.40-16.66, 65.43-65.72	18.80-20.60, 86.98-89.01

* : means infinite number.

The letter "n" (n = 1.00) indicates no inducement if the

auditor chooses test A_1. The joint strategies for the auditee and the auditor is shown under the "Joint Strategy". The numbers under "C^{NQ}_E space" (>9082) and under "D^{NQ}_E space" (>10) indicate respectively the intercepts on the x and y axes for the range of damages for the auditor and auditee. These are the ranges of damages or spaces for damage regimes within which the strategy identified is in equilibrium. The numbers under H (Auditor, and Auditee payoff) or L (Auditor, and Auditee payoff) represent the range of expected costs according with the range of damages for the auditor and auditee and the other fixed variables. The first number 39.00, or the first line of numbers 18.43-38.99, before the comma, indicates the auditor's expected cost range corresponding to his damages range. The second number 160.00, or second line of numbers 65.43-* after the comma, indicates the auditee's expected cost range corresponding to his damages range. The **bold** numbers (e.g., **33.00, 155.00**) under H or L refer to the minimum expected cost designating the joint pure strategy.

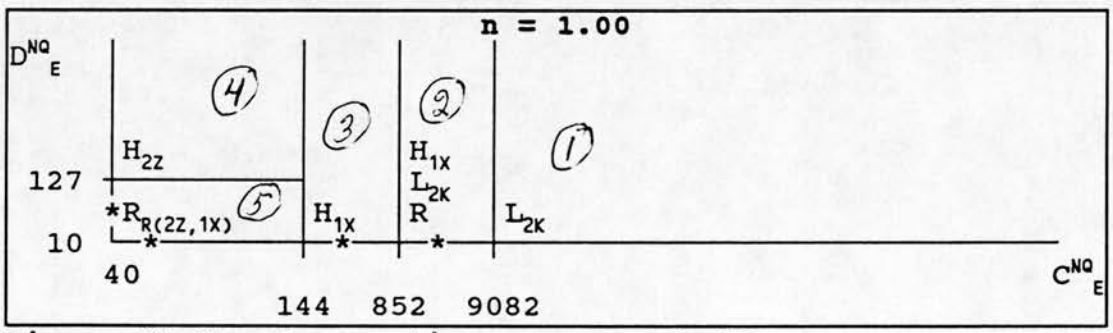


Figure 13 Non-Cooperative game n = 1.00

Figure 13 shows schematically (not to scale) the joint strategies within the auditee and the auditor damages spaces corresponding to Table 21; for example, if society imposes damages to the auditor and the auditee such that C^{NQ}_E and D^{NQ}_E are within space 5 of Figure 13, then the solution to the game is the joint randomized strategy $R_{R(2Z,1X)}$.

We will now explain the notation used for the joint strategy. The capital letter R means Randomized strategy. If the capital letter R is alone (e.g., as in space 2 in Figure 13) this means a randomization over the pure strategies within that space, in that case over H_{1X} and L_{2K}. If the capital letter R is with a subscript (e.g., $R_{R(2Z,1X)}$) it means the auditee randomizes over his strategies H and L and the auditor over his strategies s_{2Z} and s_{1X}. In that case, $R_{R(2Z,1X)}$, we can not write down R explicitly as the probabilities with which the auditee plays H, L on s_{2Z}, s_{1X} vary as damages C^{NQ}_E and D^{NQ}_E vary in that space. The capital letters L and H mean respectively Low level and High level of care taken by the auditee and are associated with a pure strategy.

A subscript to capital letter H or L could have one or two numbers alternately with capital letter and refers to the auditor's choice between tests A_2 and A_1. Two subscript numbers alternately with capital letter (e.g

H_{1X1X}) means the auditor has chosen A_1. The subscript first number and capital letter indicate the auditor strategy when the auditee has chosen H (see Appendix 1, page 200). The subscript last number and capital letter indicate the auditor strategy related to the auditee strategy L; but one subscript number (e.g., H_{2Z}, space 4 in Figure 13) means he has chosen A_2. The subscript number itself refers to the auditor's choice between tests B_1 and B_2. The subscript number itself refers to the auditor's choice between tests B_1 and B_2.

For example, if society, through a regulator and/or court imposes damages against the auditee and the auditor such that D^{NQ}_E and C^{NQ}_E fall within space 3 of Figure 13, then the solution in the game as shown in Table 21 is the joint pure strategy H_{1X}. The auditee strategy is H and the auditor strategy is s_{1X} $(A_2,B_1:Q,NQ)$.

We will now explain the calculation used for the expected payoff. For example, to calculate **16.66** the auditor payoff of the joint strategy H_{1X} in Table 21, we sum his costs and damages along with the probabilities:

$$[C_{B1} + rpC^{Q}_{E} + (1-r)pC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}\ ];$$

and for **65.43**, the payoff of the auditee (second line,

Table 21), we have:

$$[D_H + rpD^Q_E + (1-r)pD^{NQ}_E + t(1-p)D^Q_{NE} + (1-t)(1-p)D^{NQ}_{NE}].$$

Agreeing with the number given to the fixed numerical variables and the damages of $C^{NQ}_E = 144$ and $D^{NQ}_E = 10$ and n = 1.00, the auditor expected payoff is:

$$\{[3 + (0.95)(0.05)(20) + (0.05)(0.05)\mathbf{(144)} + (0.10)(0.95)(40) + (0.90)(0.95)(10)] = 16.66;$$

and the auditee expected payoff is:

$$[35 + (0.95)(0.05)(220) + (0.05)(0.05)\mathbf{(10)} + (0.10)(0.95)(120) + (0.90)(0.95)(10)]\} = 65.43.$$

The range of the auditor and auditee payoff between the relative auditor's damages 144 and 852 (144<<852) and the relative auditee's damages greater than 10 (>10) suggest the joint strategy H_{1X}.

The inducement "n" is now changed from n = 1.00 to examine the effect of changing "n" on the pattern. The end of the pattern happens at n = 0.78. In the range of n = 1.00 to n = 0.78, the auditee and the auditor stick to the same joint strategies. Table 22 shows the joint

Table 22 Non-Cooperative game n = 0.78

n = 0.78

Joint Strategy	C^{NQ}_E Space	D^{NQ}_E Space	H Auditor, and Auditee payoff	L Auditor, and Auditee payoff
L_{2K}	>9082	>10	39.00, 160.00	**33.00, 155.00**
H_{1X}	852<< 9082	>10	**18.43-38.99, 65.43- ***	33.01-176.95, 86.98- *
L_{2K}			39.00, 160.00	**33.00, 155.00**
R			**Randomized**	
H_{1X}	144<<852	>10	**16.66-18.43, 65.43- ***	20.62-32.99, 86.98- *
H_{2Z}	40<<144	>127	**11.50-16.65, 50.85- ***	20.50-56.55, 50.95- *
$R_{R(2Z,1X)}$	40<<144	10<<127	11.50-16.65, 45.00-50.80 **Randomized** 16.40-16.66, 65.43-65.72	20.50-56.55, 10.00-50.60 18.80-20.60, 86.98-89.01

* : means infinite number.

strategies according to different damages for n = 0.78.

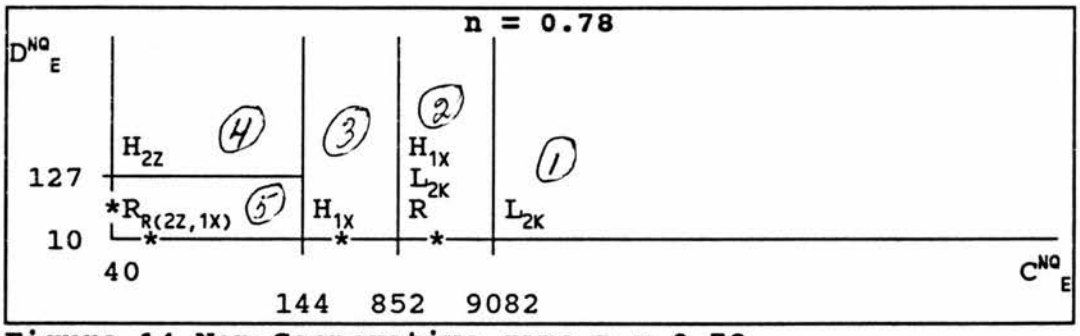


Figure 14 Non-Cooperative game n = 0.78

Figure 14 shows schematically the pattern of strategies associated with n = 0.78. Note that the dividing lines in Figure 14 are horizontal or vertical. The horizontal line belongs to the shift of strategies due to different auditee amounts of damages. The vertical lines belong to the shift of strategies due to different auditor amounts of damages. These lines mean that each player's strategy is independent of the other player's strategy. His choice of strategy results from bargaining to minimize his cost.

Note that Table 21 and Table 22 are identical except for the inducement "n". Also note that Figure 14 shows an identical pattern of strategies to Figure 13. Table 23 and Figure 15 show schematically the result representing the pattern of strategies associated with the range n = 1.00 to n = 0.78.

Pattern one

Table 23 and Figure 15 show that if society, through a regulator and/or a court, imposes relative damages against the auditor between 40 and 144 (40<<144) and the auditee between 10 and 127 (10<<127), then the auditee and the auditor choose the space identified 5 in Figure 15; that is, the randomized non-pure strategy $R_{R(2Z,1X)}$. Note that the strategy in space 5 is the same in Figure 13 for n = 1.00 and Figure 14 for n = 0.78. Consequently, the strategy is identical between n = 1.00 and n = 0.78 and we label this space 5. The name of the other spaces follows the same logic.

We will now explain the calculation of the randomized non-pure strategy equilibrium. The equilibrium in this setting is found in two stages: first, the probability the auditor will choose strategy (s means strategy) s_{2Z} (A_2,B_2,NQ,NQ; see Appendix 2, page 200) is set so that the auditor is indifferent between strategies s_{2Z} and s_{1X} (A_2,B_1,Q,NQ); second, the probability the auditee will choose strategy H is set so that the auditee is indifferent between high and low level of care. For any combination of society damages within space 5, there will be an equilibrium; however, the probabilities with which we play H,L on s_{2Z}, s_{1X} vary as C^{NQ}_E and D^{NQ}_E vary in that space. Let us look at two examples within space 5.

Firstly, if society sets a damages for the auditor of 40

Table 23 Pattern One

1.00 >= n >= 0.78

Joint Strategy	C^{NQ}_E Space	D^{NQ}_E Space	H Auditor, and Auditee payoff	L Auditor, and Auditee payoff
L_{2K}	>9082	>10	39.00, 160.00	**33.00, 155.00**
H_{1X}	852<< 9082	>10	**18.43-38.99, 65.43- ***	33.01-176.95, 86.98- *
L_{2K}			39.00, 160.00	**33.00, 155.00**
R			**Randomized**	
H_{1X}	144<<852	>10	**16.66-18.43, 65.43- ***	20.62-32.99, 86.98- *
H_{2Z}	40<<144	>127	**11.50-16.65, 50.85- ***	20.50-56.55, 50.95- *
$R_{R(2Z,1X)}$	40<<144	10<<127	11.50-16.65, 45.00-50.80	20.50-56.55, 10.00-50.60
			Randomized	
			16.40-16.66, 65.43-65.72	18.80-20.60, 86.98-89.01

* : means infinite number.

(40 on x axis) and for the auditee of 10 (10 on y axis), the auditor chooses s_{2Z} with probability 0.38 and s_{1X} with probability 0.62, whereas the auditee chooses H with probability 0.26 and L with probability 0.74. (For detailed techniques in deriving randomized equilibria, see Thomas, 1984). The expected "value" (cost) of this game according to damages set is (18.18, 57.64); 18.18 for the auditor and 57.64 for the auditee. The

calculation for the auditor (18.18) is:

(2155/5655 [11.50(17/66) + 20.50(49/66)] + 3500/5655 [16.40(17/66) + 18.80(49/66)]);

and for the auditee (57.64) is:

(17/66 [45(2155/5655) + 65.43(3500/5655)] + 49/66 [10(2155/5655) + 86.98(3500/5655)]).

Secondly, if society sets damages equal to 143 (143 on x axis) for the auditor and 126 (126 on y axis) for the auditee, the auditor chooses s_{2z} with probability 0.99 and s_{1x} with probability 0.01, whereas the auditee chooses H with probability asymptotic to 1.00 and L with probability asymptotic to 0.00. The expected "value" (cost) of this game is (16.66, 50.93); 16.66 for the auditor and 50.93 for the auditee. The expected "value" of the last game is less than the first game (18.18, 57.64) set at the lowest damages within that space. The auditee, by his effort, influences favourably the value of the game.

The other spaces suggest at least one pure strategy. These strategies are identical for n varying between 1.00 and 0.78.

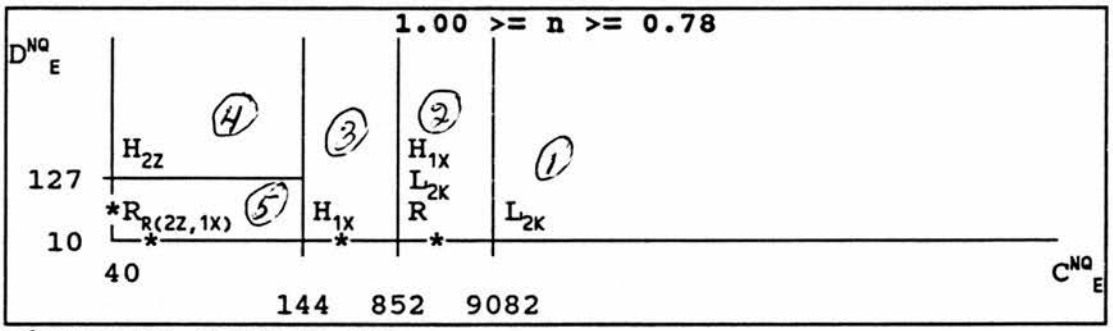


Figure 15 Pattern One

The space identified 1 in Figure 15, L_{2K} is for the highest damages and suggests that both the auditee and the auditor give up in terms of effort. The auditor qualifies no matter if a material error is found or not, and the auditee takes low care over the accounting information system. This strategy corroborates that a low-pooling equilibrium exists when damages are high in relation to the audit benefit.

The space identified 2 in Figure 15, H_{1X}, L_{2K}, and R (randomized over pure strategies H_{1X} and L_{2K}), suggests that both the auditee and the auditor randomized over two pure strategies. The unique Nash equilibrium implies a distribution of probability over them. Thus, as an illustration, the auditor may choose to play s_{1X} with probability 0.42 and s_{2K} with probability 0.58; similarly, the auditee may choose the same probabilities over H and L.

The space identified 3 in Figure 15, H_{1X}, suggests that both the auditee and the auditor agree to higher effort

and cost. The auditor has chosen the extended audit test B_1 and his audit opinion relies on the test's signal; at the same time, the auditee has chosen the highest level of care H.

The space identified 4 in Figure 15, H_{2Z}, bounded on the x axis $40 < C^{NQ}_{E} < 144$, and y axis $D^{NQ}_{E} > 127$ has only a pure strategy. It is suggested that only the auditee agrees to higher effort and has chosen the highest level of care H.

Table 24 Auditee and Auditor effort

1.00 >= n >= 0.78

Figure space	Joint strategy	Auditee Effort	Auditor Effort
1	L_{2K}	Low	Minimum
2	H_{1X}, L_{2K} and R	Randomized on H, L	Randomized on B_1, B_2
3	H_{1X}	High	B_1
4	H_{2Z}	High	Minimum
5	$R_{R(2Z,1X)}$	Randomized on H, L	Randomized on B_1, B_2

The space identified 5 in Figure 15 bounded on the x axis

$40 < C^{NQ}_{E} < 144$, and y axis $10 < D^{NQ}_{E} < 127$ has two randomized strategies $R_{R(2Z,1X)}$.

If society adopts a policy towards the audit which encourages high effort by the auditee, then this implies the adoption of spaces 2, 3, 4 and 5 for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E). A choice of damages from space 4 (H_{2Z}, Figure 15), where the auditor does not qualify no matter if a material error is found or not, implies that society perceives the function of the audit as being not to find material error, but rather to induce higher effort on the part of the auditee and thus reduce the likelihood of material error. Note that the auditee randomizes within spaces 2 and 5.

If society therefore adopts a policy towards the audit which encourages randomized effort (high and low) by the auditee, then this implies the adoption of spaces 2 (H_{1X}, L_{2K} and R) and 5 ($R_{R(2Z,1X)}$). One of the advantages of encouraging randomized strategies is that it adds an uncertainty which could confuse the other player.

The auditee's choice has the same pattern throughout the illustration of non-cooperative games; thus the above analysis related strictly to the auditee applies throughout all the patterns revealed by the non-

cooperative game.

Table 25 Pattern One: Auditor strategies choice

1.00 >= n >= 0.78

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
>9,082	1	A_2, B_2: Q, Q	
852-9,082	2	A_2, B_1: Q,NQ or A_2, B_2: Q, Q	B_1
144-852	3	A_2, B_1: Q,NQ	B_1
40-144	4	A_2, B_2:NQ,NQ	
40-144	5	A_2, B_2:NQ,NQ or A_2, B_1: Q,NQ	B_1

or: means the auditor randomizes over the strategies

As shown in Figure 15 and Table 25, the auditor's high effort, for the range n = 1.00 to n = 0.78, is B_1, and therefore his audit opinion is qualified if test B_1 signals a material error and otherwise is not qualified. As regards auditor high effort, none of the four auditor's strategies (Table 25) corresponding to the five spaces (Figure 15) includes test A_1 which reveals the auditee's strategy; hence the most rigorous audit work is that of space 3 (H_{1X}) which includes the extended test,

B_1.

Consequently, the inducement "n" must be less than 0.78 to convince the auditor to choose A_1. Mathematically, the reduction of damages to n = 0.78 does not cover the fixed fees C_{A1} in any space within this pattern.

If society adopts a policy towards the audit which encourages qualification outcome dependent on the result of test B_1 by the auditors, then this implies the adoption of space 3 (H_{1X}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E).

If society adopts a policy towards the audit which encourages high effort by the auditee and a qualification outcome dependent on the result of test B_1 by the auditor, then it is looking ideally for the parties to adopt space 3 (H_{1X}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E).

The essential features of pattern one are:
1) society could influence the auditor behaviour by adopting auditee damages policies in respect of the audit;
2) society could not influence the auditee behaviour by

adopting different auditee damages except for space 4 and 5;

3) the audit opinion (qualified/non-qualified) could not be contingent on the auditee's choice, since the auditor does not know that choice (he does not play A_1).

Let us examine the effect of changing the range of "n" from 1.00 to 0.78 (pattern one) to 0.76 to 0.67 (pattern two); but first, let us explain how a reduced normal form using the unique inducement n = 0.77 works although Table 26 for n = 0.77 is not a pattern of its own as defined above. We do not present it as a pattern because of its peculiarity of being a unique, discrete point and the difficulty for society to secure a policy on a discrete point.

Reduced normal form

Many games can be simplified through the use of dominance arguments. Table 26 shows the equilibrium pairs before applying the principle of dominance. The reduced normal form is obtained by removing the dominated equilibrium pairs.

Table 26, n = 0.77, represents relative damages for the auditor between 8698 and 9198 and for the auditee between

Table 26 Game in Normal Form

n = 0.77

8698 < C^{NQ}_E < 9198

Joint strategy	Auditor strategy	D^{NQ}_E	H Auditor, and Auditee payoff	L Auditor, and Auditee payoff
H_{1X1K}	A_1,B_1: Q,NQ A_1,B_1: Q, Q	16<< 43	**38.04-38.99,** **65.44-65.51**	41.00, 155.00
H_{1X1X}	A_1,B_1: Q,NQ A_1,B_1: Q,NQ	#	**38.04-38.99,** **65.44-65.51**	140.31-146.96, 87.08-87.54
H_{1X1Y}	A_1,B_1: Q,NQ A_1,B_1:NQ, Q	#	**38.04-38.99,** **65.44-65.51**	2259-2386, 80.02-88.67
H_{1X2X}	A_1,B_1: Q,NQ A_1,B_2: Q,NQ	#	**38.04-38.99,** **65.44-65.51**	490.80-517.42, 87.10-88.92
H_{1X2Y}	A_1,B_1: Q,NQ A_1,B_2:NQ, Q	#	**38.04-38.99,** **65.44-65.51**	1903-2009, 80.01-87.29
L_{2K}	A_2,B_2: Q, Q		39.00, 160.00	**33.00, 155.00**

means dominated joint strategy

16 and 43. A # identifies the dominated equilibrium pairs within Table 26. For example, if the auditee has chosen his strategy H, the auditor could play any of these strategies: s_{1X1K}, s_{1X1X}, s_{1X1Y}, s_{1X2X}, s_{1X2Y}, and he has the same payoff; but if the auditee has chosen his strategy L, the auditor, as an intelligent and rational decision maker, maximizes his utility by choosing only strategy, among those strategies, s_{1X1K} which minimizes his cost. The expected cost range for the auditor of joint strategies L_{1X1K}, 41.00, is less than the expected cost range of the other joint strategies except the last one

(L_{2K}).

Table 27 Reduced Normal Form

n = 0.77

8698 < C^{NQ}_E < 9198

Joint strategy	Auditor strategy	D^{NQ}_E	H Auditor, and Auditee payoff	L Auditor, and Auditee payoff
H_{1X1K}	A_1,B_1: Q,NQ	16<<	**38.04-38.99,**	41.00, 155.00
	A_1,B_1: Q, Q	43	**65.44-65.51**	
L_{2K}	A_2,B_2: Q, Q		39.00, 160.00	**33.00, 155.00**

Table 27 shows the reduced normal form of game. The four other joint strategies (H_{1X1X}, H_{1X1Y}, H_{1X2X} and H_{1X2Y}) are dominated joint strategies that need not appear in the solution.

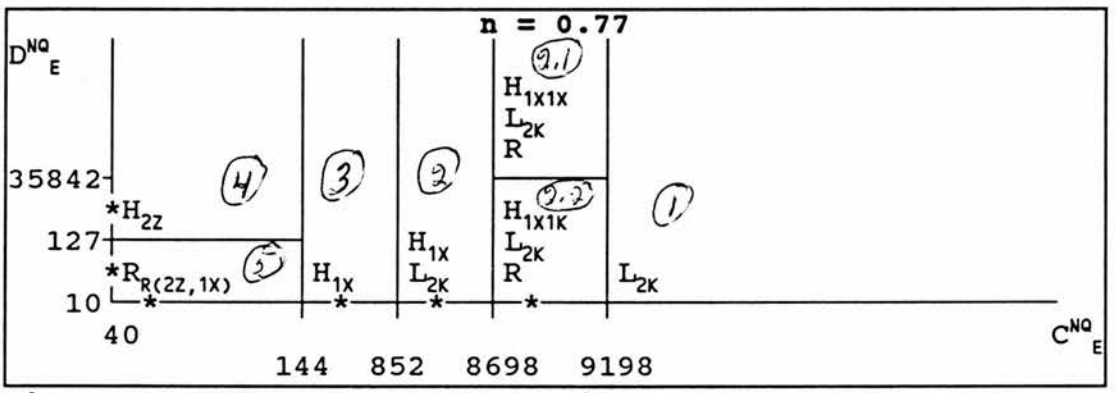


Figure 16 Reduced non-cooperative game n = 0.77

Figure 16 shows the strategies after applying the principle of dominance. Note that the inducement n = 0.77 incites the auditor within spaces 2.1 and 2.2 to

employ test A_1, the test revealing the auditee's strategy; hence the fixed fee of test A_1, C_{A1}, has been covered at the n = 0.77. Within this chapter only the joint strategies that the equilibrium pairs are not dominated last in the figures. Through the following patterns, the analysis is only from the reduced normal form of the game.

It should be remembered that this pattern n = 0.77 is used only to show how an illustration of the dominance concept. Let us examine the effect of changing the range of "n" from 1.00 to 0.78 (pattern one) to 0.76 to 0.67 (pattern two).

Pattern two

As previously stated in pattern one, none of the auditor strategies includes test A_1, the test which reveals to the auditor the auditee strategy. To encourage the inclusion of test A_1 in the auditor's strategy, it is necessary to offer an incentive in the form of a percentage less than 0.78 ($n < 0.78$) payable on the total damages otherwise suffered by the auditor in the event of a failure to qualify a materially inaccurate set of statements.

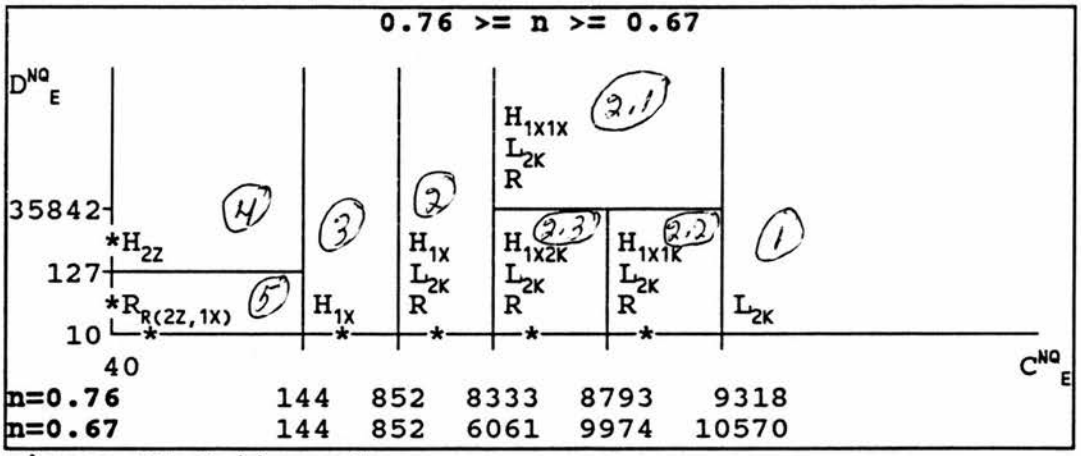


Figure 17 Pattern Two

We will now explain the supplement notation (e.g., H_{1X1X}) in Figure 17. We must remember that two subscript numbers alternately with a capital letter means the auditor has chosen A_1. The subscript first number and capital letter indicate the auditor strategy when the auditee has chosen H (see Appendix 2, page 200). The subscript last number and capital letter indicate the auditor strategy related to the auditee strategy L. The subscript number itself refers to the auditor's choice between tests B_1 and B_2. The subscript capital letter refers to the auditor's action: K = Q,Q; X = Q,NQ; Y = NQ,Q; and Z = NQ,NQ; as a result, the auditor's strategy is to "threaten" the auditee.

For example, in spaces 2.2 and 2.3 (Figure 17), if the auditor has chosen test A_1 and the auditee has chosen High level of care of the accounting information, the auditor chooses test B_1 and his opinion is dependent on the result of the latter test; that is, 1X. However, if the auditee

has chosen Low level of care, the auditor threatens him with qualifying, no matter if a material error is found or not.

The numbers of threats and the threat itself vary with the auditee's relative damages selected by society; for example, if the auditee's relative damages (space 2.2 and 2.3) is between 10 and 35,842, the auditor's threat (K = Q,Q) if the auditee has shirked is to qualify no matter if a material error is found or not; nevertheless, these threats are less of an answer than they appear to be.

An audit strategy where the opinion is insensitive to the audit results such as qualify or not qualify no matter if a material error is found or not (K = Q,Q or Z = NQ,NQ), or is opposite to the result of the B test (2Y or 1Y), does not improve welfare. The only strategies which could improve welfare is 1X or 2X which have a qualification outcome dependent on the result of the B test. The purpose of society's audit policy is not to analyze threats; hence the precise nature of a threat is unimportant, and the threats are therefore identified by ?? throughout the analysis of the patterns, although the threat is still identified in the figure.

Figure 17 shows schematically the pattern of strategies associated with the range n = 0.76 to n = 0.67. The only

change in Figure 17 from Figure 15 happens between space 1 and 2. There are three new spaces that are 2.1, 2.2 and 2.3. These new spaces are an extension of space 2. They have the same strategy root (H_{1X}, L_{2K}, and R) and only one of them (H_{1X}) is extended with a threat ($H_{1X??}$) if the auditee has chosen Low level of care. The other spaces are identical to pattern one.

Spaces 2.1, 2.2, and 2.3 suggest that the auditor agrees to employ the test A_1 which reveals the auditee's strategy within one of his strategies; however, only within space 2.2 and 2.3 does the auditor threaten the auditee. If test A_1 reveals that the auditee has chosen High level of care, the auditor chooses the extended test B_1, and his audit opinion relies on his observation of the test signal; otherwise, he qualifies (threat) no matter if a material error is found or not. Within the same spaces, the auditee randomizes over H and L. Note that the fixed fee of test A_1, C_{A1}, has been covered at the starting range n = 0.76.

To calculate the damages limit, C^{NQ}_E, the cost of H_{1X} is set equal to $H_{1X??}$ and by elimination we obtain:

$$(1-r)pC^{NQ}_E = C_{A1} + (1-r)pnC^{NQ}_E; \qquad (1)$$

and the lower limit is obtained by isolating C_{A1} from the

equation (1) and solving for C^{NQ}_E:

$$C^{NQ}_E = C_{A1}/(1-n)(1-r)p; \quad (2)$$

and the upper limit, as shown in Figure 13 for n = 1.00, must equal 9,082, the maximum damages before the auditor gives up in terms of effort and qualifies no matter if a material error is found or not (space 1). So putting 9,082 in equation (1), we obtain:

$$(1-r)p(9,082) = C_{A1} + (1-r)pnC^{NQ}_E; \quad (3)$$

isolating nC^{NQ}_E from the equation (3) and solving for C^{NQ}_E:

$$C^{NQ}_E = \{[(9,082) - C_{A1}/(1-r)p]/n\}. \quad (4)$$

For example, in Figure 17, for n = 0.76, C_{A1} = 5, p = 0.05 and r = 0.95, the lower limit is 5/(0.24)(0.05)(0.05) = 8,333 and the upper is {[9,082 - 5/(0.05)(0.05)]/(0.76)} = 9,318.

As shown in Figure 17 and Table 28, the auditor's high efforts are A_1 and B_1, A_1, and B_1. As regards the auditor's highest effort, one of his strategies (Table 28) corresponding to spaces 2.1, 2.2, and 2.3 (Figure 17) includes randomly the test revealing the auditee's strategy A_1 and the extended test B_1; hence the

Table 28 Pattern Two: Auditor strategies choice

0.76 >= n >= 0.67

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
>9,318; 10,570	1	A_2, B_2: Q, Q	
8,333-9,318 6,061-10,570	2.1, 2.2, and 2.3	A_1, B_1: Q,NQ A_1, B_2: ?, ? or A_2, B_2: Q, Q	A_1 and B_1 A_1
852-8,333 852-6,061	2	A_2, B_1: Q,NQ or A_2, B_2: Q, Q	B_1
144-852	3	A_2, B_1: Q,NQ	B_1
144-852	4	A_2, B_1:NQ,NQ	
40-144	5	A_2, B_2:NQ,NQ or A_2, B_1: Q,NQ	 B_1

or: means the auditor randomizes over the strategies

most rigorous audit work is within these spaces.

If society adopts a policy towards the audit which encourages the auditor to employ test A_1, then this implies the adoption of spaces 2.1, 2.2, and 2.3 ($H_{1X??}, L_{2K}$ and R).

If society adopts a policy towards the audit which encourages high effort by the auditees and selection of

test A_1 and qualification outcome dependent on the result of test B_1 by the auditor, then it is looking for the parties to adopt spaces 2.1, 2.2, and 2.3 ($H_{1X??}$, L_{2K} and R).

Note that an increase of auditee's damages influences the auditor's possible threat; for example, at auditee damages greater than 35,842, the auditor in the space 2.1 agrees to choose test B_1 no matter what the auditee strategy and his qualification outcome relies on the test's signal.

The essential feature of pattern two is that society could influence the auditor to employ test A_1 which reveals the auditee's strategy. High auditee damages result in the auditor choosing test B_1 no matter what the auditee strategy, which suggests that the auditor is preoccupied by the material error and does not threaten the auditee; but society's welfare is worse than that provided by the space 2 because the cost to employ test A_1 and the threat of such damages are useless.

Let us examine the effect of changing the range of "n" from 0.76 to 0.67 (pattern two) to 0.66 to 0.53 (pattern three).

Pattern three

Figure 18 shows schematically the pattern of strategies associated with the range n = 0.66 to n = 0.53. The only change in Figure 18 from Figure 17 happens between spaces 2 and 3. There are two new spaces that are 2.4 and 2.5. These new spaces are an extension from space 2. They have the same strategy root (H_{1X}, L_{2K}, and R) and only the auditor's action 1X is extended with a threat ($L_{??1X}$) if the auditee has chosen High level of care.

These new spaces suggest that if the auditee has chosen High level of care, then the auditor, when he employs test A_1, can only afford a dominant strategy as a threat that is qualified if the auditee damages are less than 1302, and non-qualified if they are more than 1302 no matter if a material error is found or not. However, if the auditee has chosen Low level of care, the auditor chooses test B_1 and his qualification outcome depends on its signal. The other spaces are identical to pattern two.

Spaces 2.4 and 2.5 suggest that the auditor agrees to employ the test A_1 within one of his strategies. If test A_1 reveals that the auditee has chosen Low level of care, the auditor chooses the extended test B_1, and his audit opinion relies on his observation of the test signal; otherwise he threatens the auditee. Within the same spaces, the auditee randomizes over H and L.

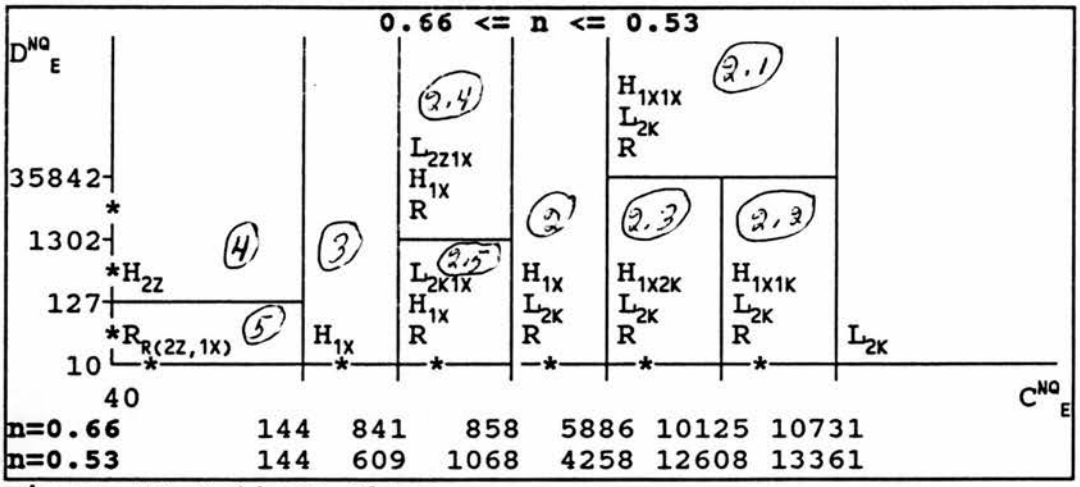


Figure 18 Pattern Three

The auditee's best strategy within these two spaces is Low level of care. If the auditor has employed the test A_1, and the auditee Low level of care, the auditee avoids the auditor threats. If the auditor does not employ test A_1, he does not know the auditee strategy. In these two strategies the auditor chooses test B_1 and his audit opinion relies on his observation of the test signal; therefore, a choice of auditor's damages from this space implies that society perceives the function of the audit as being to put the responsibility for a material error on the auditor.

An interpretation of the auditor's behaviour could be that, if the auditee has chosen H, it is not worthwhile to carry out any extended test; but if he has chosen L, the auditor chooses the extended test B_1 and his audit opinion relies on the test signal.

Table 29 Pattern Three: Auditor strategies choice

0.66 >= n >= 0.53

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
>10,731; 13361	1	A_2, B_2: Q, Q	
5,886-10,731 4,258-13,361	2.1, 2.2, and 2.3	A_1, B_1: Q,NQ A_1, B_2: ?, ? or A_2, B_2: Q, Q	A_1 and B_1 A_1
858-5,886 1,068-4,258	2	A_2, B_1: Q,NQ or A_2, B_2: Q, Q	B_1
841-858 609-1,068	2.4 and 2.5	A_1, B_2: ?, ? A_1, B_1: Q,NQ or A_2, B_1: Q,NQ	A_1 A_1 and B_1 B_1
144-841 144-609	3	A_2, B_1: Q,NQ	B_1
40-144	4	A_2, B_2:NQ,NQ	
40-144	5	A_2, B_2:NQ,NQ or A_2, B_1: Q,NQ	 B_1

or: means the auditor randomizes over the strategies

As shown in Figure 18 and Table 29, the auditor's high efforts are A_1 and B_1, A_1, and B_1. As regards the auditor highest efforts, one of his strategies (Table 29) within spaces 2.1, 2.2, 2.3, 2.4, and 2.5 includes the test revealing the auditee's strategy, test A_1, and the extended test, B_1; hence the most rigorous audit work is

within these spaces.

If society adopts a policy towards the audit which encourages the auditor to employ test A_1, then this implies the adoption of spaces 2.1, 2.2, 2.3, 2.4, and 2.5.

If society adopts a policy towards the audit which encourages high effort by the auditees and selection of test A_1 and qualification outcome dependent on the result of test B_1, then it is looking ideally for the parties to adopt spaces 2.1, 2.2, 2.3, 2.4, and 2.5.

The essential feature of pattern three within spaces 2.4 and 2.5 implies that society perceives the function of the audit as being to find material error by the auditor.

Let us examine the effect of changing the range of "n" from 0.52 to 0.51.

Pattern four

Figure 19 shows schematically the pattern of strategies associated with the range n = 0.52 to n = 0.51. The only change in Figure 19 from Figure 18 happens in space between the y axis and space 5. There are five new

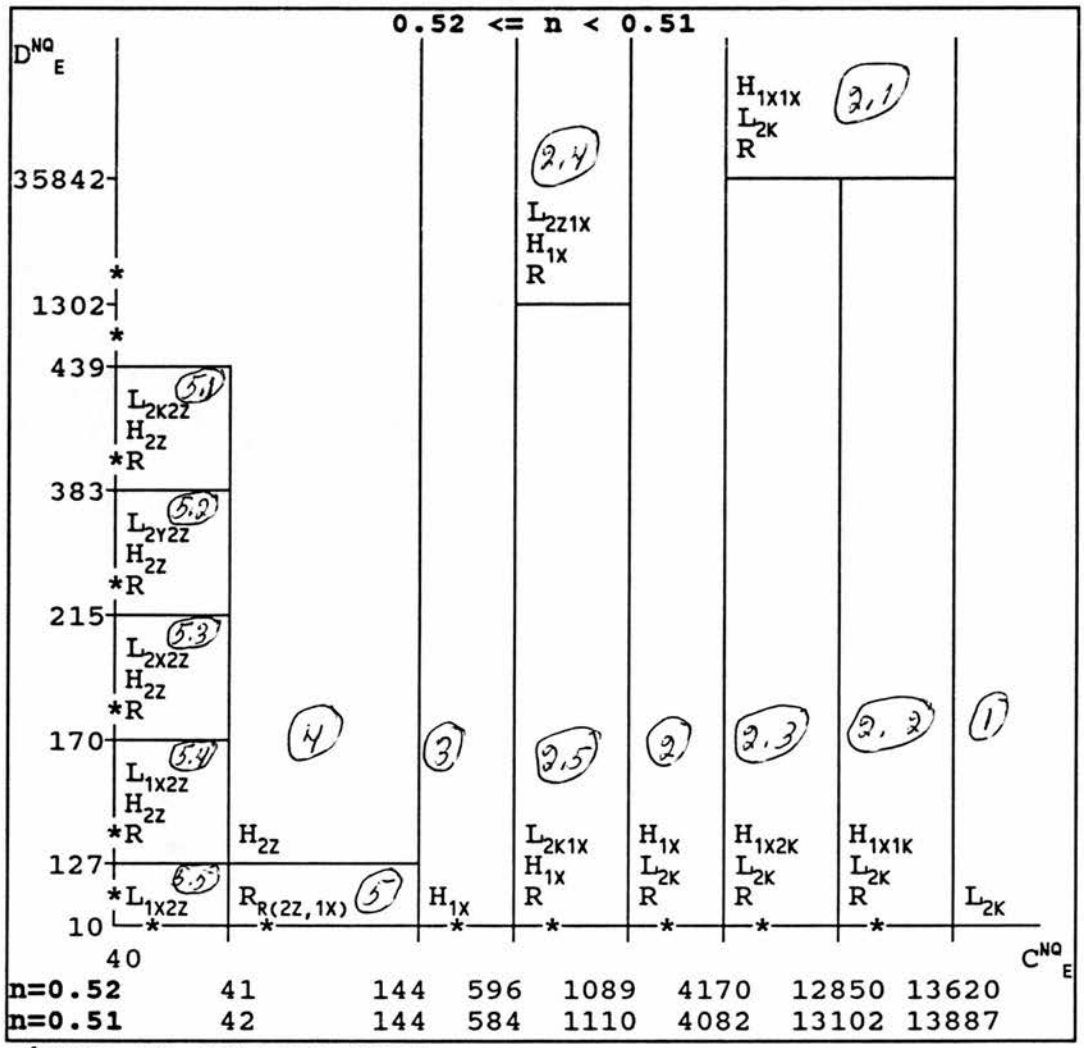


Figure 19 Pattern Four

spaces that are 5.1, 5.2, 5.3, 5.4, and 5.5. They have the same strategy root ($R_{R(2Z1X)}$); remember that R with subscripts could be H or L, and only the auditor's action 2Z is extended with a threat ($L_{??2Z}$) if the auditee has chosen High level of care. The threats are any action except 2Z. The auditor does not agree to any effort within those five spaces except test A_1 to get the inducement and reveal the auditee's strategy. The other spaces are identical to pattern three.

Spaces 5.1, 5.2, 5.3, 5.4, and 5.5 suggest that the auditor agrees to employ test A_1 within one of his strategies. If test A_1 reveals that the auditee has chosen Low level of care, he does not qualify no matter if a material error is found or not; otherwise, he threatens the auditee with any of the other actions. Within the same spaces the auditee randomizes over H and L.

The auditee's best strategy within these five spaces is Low level of care. If the auditor has employed the test A_1 and the auditee Low level of care, the auditor does not qualify no matter whether a material error is found or not. If the auditor does not employ test A_1, he does not know the auditee strategy and he does not qualify no matter whether a material error is found or not: therefore, a choice of damages from this space implies that society perceives the function of the audit as being to keep down cost; either because the auditor does not apply test A_1 or, if he does (to earn the discount), because he then forces the auditee to make low effort.

As shown in Figure 19 and Table 30, the auditor's high efforts are A_1 and B_1, A_1, and B_1. As regards the auditor's highest effort, one of his strategies (Table 30) in space 5.1, 5.2, 5.3, and 5.4, and the only one in space 5.5 (Figure 19), includes the test revealing

Table 30 Pattern four: Auditor strategies choice

0.52 >= n >= 0.51

Damages adopted by society	Figure space	Auditor's strategy	Auditor's effort
>13,620; 13,887	1	A_2, B_2: Q, Q	
4,170-13,620	2.1,	A_1, B_1: Q,NQ	A_1 and B_1
4,082-13,887	2.2,	A_1, B_2: ?, ?	A_1
	and	or	
	2.3	A_2, B_2: Q, Q	
1,089-4,170	2	A_2, B_1: Q,NQ	B_1
1,110-4,082		or	
		A_2, B_2: Q, Q	
596-1,089	2.4	A_1, B_2: ?, ?	A_1
584-1,110	and	A_1, B_1: Q,NQ	A_1 and B_1
	2.5	or	
		A_2, B_1: Q,NQ	B_1
144-596	3	A_2, B_1: Q,NQ	B_1
144-584			
40-144	4	A_2, B_2:NQ,NQ	
40-144	5	A_2, B_2:NQ,NQ	
		or	
		A_2, B_1: Q,NQ	B_1
40-41	5.1,	A_1, B_2: ?, ?	A_1
40-42	5.2,	A_1, B_2:NQ,NQ	A_1
	5.3,	or	
	and	A_2, B_2:NQ,NQ	
	5.4		
40-41	5.5	A_1, B_2: ?, ?	A_1
40-42		A_1, B_2:NQ,NQ	A_1

or: means the auditor randomizes over the strategies

the auditee's strategy A_1.

If society adopts a policy towards the audit which encourages the auditor to employ test A_1, then this implies the adoption of spaces 2.1, 2.2, 2.3, 2.4, 2.5, 5.1, 5.2, 5.3, 5.4, and 5.5. A choice of spaces 5.1, 5.2, 5.3, 5.4, and 5.5 incites the auditee to choose low level of care.

The essential feature of pattern four within spaces 5.1, 5.2, 5.3, 5.4, and 5.5 is society's perception that the function of the audit is to keep down cost either by encouraging the auditor to not play test A_1, or if he does (to earn the discount and reveal the auditee's strategy), then he forces the auditee to make low effort.

Let us look at the summary of these four patterns.

Summary

The following summary centres on the possible attitudes of society towards the patterns by the auditee and the auditor.

If society adopts a policy towards the audit which encourages high effort by the auditee, then this implies the adoption of spaces 3 and 4 for the selection of damages associated with a non-qualified opinion (NQ) when

the state of accounting information is in error (E).

If society adopts a policy towards the audit which encourages randomized effort (high and low) by the auditee, then this implies the adoption of spaces 2, 2.1, 2.2, 2.3, 2.4 and 2.5; 5, 5.1, 5.2, 5.3, 5.4, and 5.5.

If society adopts a policy towards the audit which encourages qualification outcome dependent on result of test B_1 by the auditors, then this implies the adoption of space 3 (H_{1X}) for the selection of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E).

If society adopts a policy towards the audit which encourages only the auditee to make high effort and a qualification outcome dependent on the result of test B_1 by the auditor, then it is looking ideally for the parties to adopt space 3 (H_{1X}).

If society adopts a policy towards the audit which encourages the auditor to employ test A_1, then this implies the adoption of spaces 2.1, 2.2, 2.3, 2.4, 2.5, 5.1, 5.2, 5.3, 5.4, and 5.5.

If society adopts a policy towards the audit which encourages high effort by the auditees and selection of

test A_1 and qualification outcome dependent on the result of test B_1, then it is looking ideally for the parties to adopt spaces 2.1, 2.2, 2.3, 2.4, and 2.5.

Let us examine the overlap of pattern one of cooperative and non-cooperative game.

Overlapped pattern one

Can the same pair of strategies be a solution of a cooperative and non-cooperative game? Could a cooperative game shows the same choice of strategies as a non-cooperative game within the same space; that is, within the same society damages regime? Starting from the strategies within these spaces, we can not differentiate if the players play a cooperative or a non-cooperative game.

The interest of overlapping cooperative and non-cooperative game patterns is to observe the similarities between the two games; furthermore, we will see where the line is drawn between a cooperative and a non-cooperative strategy. Could a cooperative game appear to be a non-cooperative game? Some spaces are identical.

The overlap is interesting; for example, if C^{NQ}_{E}, D^{NQ}_{E} are

selected from an overlapping zone then the game can be represented as non-cooperative for public consumption; that is, the auditor is independent, but in reality the game is played as cooperative.

Figure 20 shows the overlap of pattern one from the cooperative and non-cooperative games. Only the similar strategy spaces are identified. Spaces 1, 3, and 4 (L_{2K}, H_{1X}, and H_{2Z}) are the same for the two different games. Within these spaces there is no strategy differentiation between the cooperative and non-cooperative game.

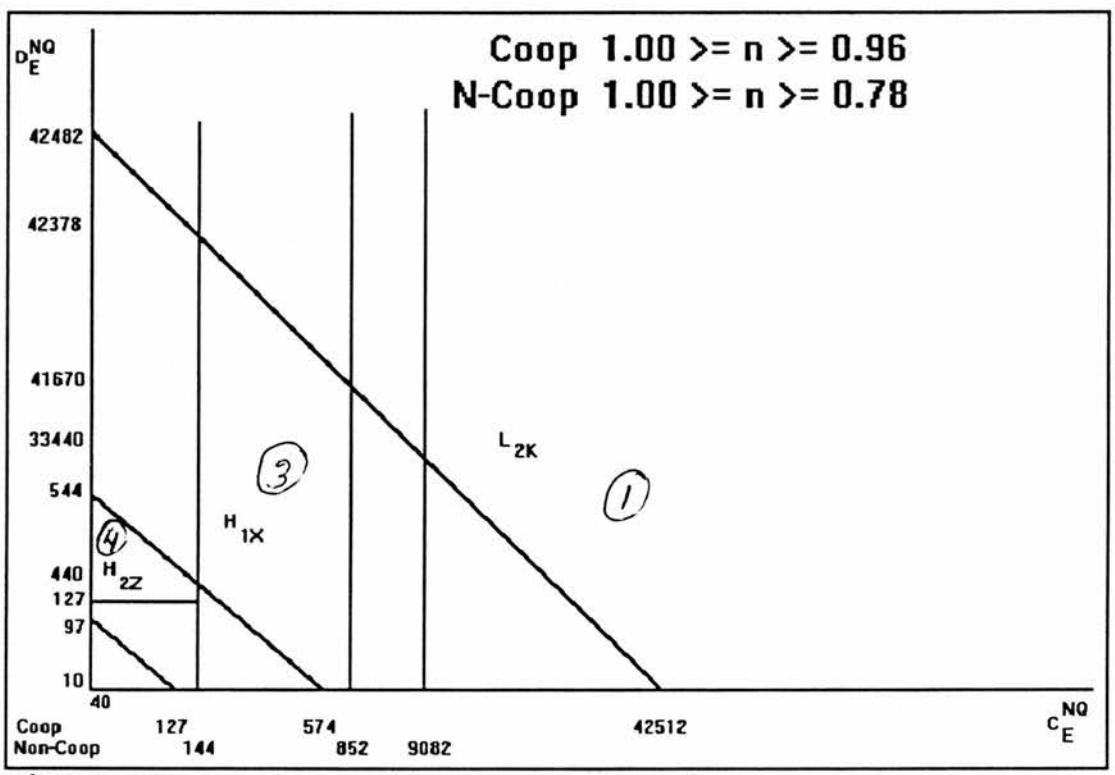


Figure 20 Overlap pattern one

If society adopts a policy towards the audit which

encourages high effort by the auditees, then this implies the adoption of spaces 3 (H_{1X}) and 4 (H_{2Z}). A choice of damages from space 4 (H_{2Z}) where the auditor does not qualify no matter if a material error is found or not, implies that society perceives the function of the audit as being not to find material error, but rather to induce higher effort on the part of the auditee and thus reduce the likelihood of material error.

If society adopts a policy towards the audit which encourages high effort by the auditees and qualification outcome dependent on the result of test B_1 by the auditor, then it is looking ideally for the parties to adopt the space 3 (H_{1X}). A choice of damages from space 3 (H_{1X}), where the auditee has chosen High level of care and the auditor qualification outcome relies on the extended test B_1's signal, implies that society perceives the function of the audit as being to reduce the likelihood of material error and to find it if it does occur.

As regards the auditor's high effort, none of the three spaces includes test A_1 which reveals the auditee's strategy; hence the most rigorous audit work is that of space 3 (H_{1X}) which includes the extended test B_1.

Let us examine the overlap of patterns when the auditor has employed test A_1 which reveals the auditee's strategy.

Overlapped pattern two

Figure 21 shows the overlap of pattern four from the cooperative game and pattern two from the non-cooperative game. We must remember that pattern two from the non-cooperative game (0.76 >= n >= 0.67) is the first pattern in which the auditor agrees to employ test A_1 which reveals the auditee's strategy. The only pattern from the cooperative game which encloses the inducement of pattern two from non-cooperative game is pattern four; that is, the non-cooperative inducement space 0.76 >= n >= 0.67 is enclosed within the cooperative one 0.82 >= n >= 0.65. Only the similar strategy spaces are identified. Spaces 1; 2.1, 2.2, 2.3 and 3.1; 3; and 4 (L_{2K}, H_{1X--}, H_{1X}, and H_{2Z}) are the same for the two different games. Within these spaces there is no strategy differentiation between the cooperative and non-cooperative game.

If society adopts a policy towards the audit which encourages high effort by the auditees, then this implies the adoption of all similar spaces (H_{1X--}, H_{1X}, and H_{2Z}) except space 1 (L_{2K}). A choice of damages from space 4 (H_{2Z}) in which the auditor does not qualify no matter if a material error is found or not, implies that society

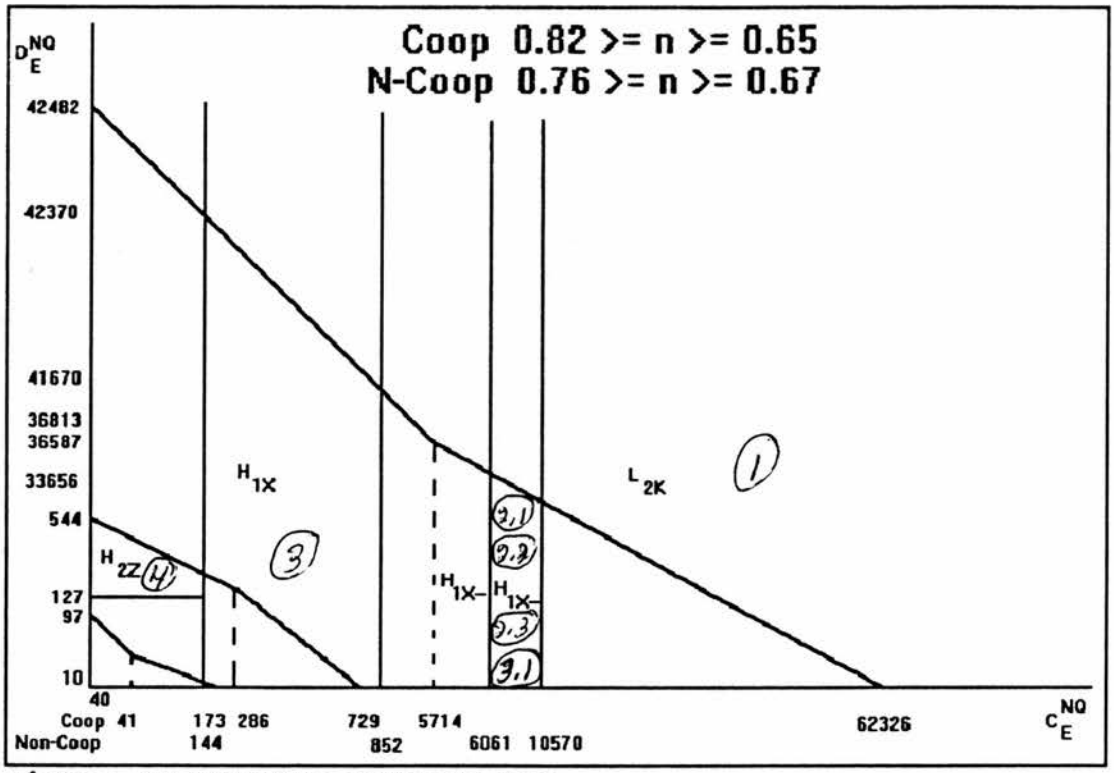


Figure 21 Overlap pattern two

perceives the function of the audit as being not to find material error, but rather to induce higher effort on the part of the auditee and thus reduce the likelihood of material error.

If society adopts a policy towards the audit which encourages qualification outcome dependent on result of test B_1 by the auditor, then this implies the adoption of space 3 (H_{1X}).

If society adopts a policy towards the audit which encourages high effort by the auditees and selection of test A_1 and qualification outcome dependent on the result of test B_1 by the auditor, then it is looking ideally for

the parties to adopt spaces 2.1, 2.2, 2.3 and 3.1 (H_{1X--}). A choice of damages from these spaces, where the auditee has chosen High level of care and the auditor qualification outcome relies on the extended test B_1 signal, implies that society perceives the function of the audit as being to reduce the likelihood of material error and to find it should it occur and reveal the auditee's strategy.

Consequently, as illustrated in Figure 21, the overlap of cooperative game pattern four (Figure 8, page 117) over non-cooperative game pattern two (Figure 15, page 149) with an inducement "n" of 0.76 or less must convince the auditor to choose test A_1 within any of the two types of game.

The essential feature of overlap pattern two is that society could influence the auditor to choose test A_1 by adopting an inducement "n" of 0.76 or less, without consideration of the type of game.

Conclusion

Non-cooperative games may, as is the case here, include communication between the parties. A few relevant observations about this game are in order. First, it is

an example of a non-cooperative game, meaning the players are unable to make a binding and enforceable agreement. If such a binding agreement is possible, then they would cooperate. Second, if nothing really hinges on their being unable to communicate but neither trusts the other, then the dilemma still exists. Third, it is not necessary to measure the value or utility of the outcomes of the players; information about their preference orderings is sufficient. Fourth, the players need not be facing the same decision, nor have identical sets of alternative courses of action. The essential factor is the pattern of interaction between the possible actions and the player's preferences for the outcomes.

This chapter has explored, through a non-cooperative game theory of the audit, how the auditee's and the auditor's strategic choices are influenced by the damages imposed on the auditee and the auditor for issuing a materially inaccurate set of statements without a qualified audit opinion. It is seen that these damages must be established mainly for the auditor within a specific range of "n" and specified spaces, the choice of "n" and spaces being dependent upon the policy objectives of society. Possible policy objectives considered are: (1) to induce the auditee to make high effort; (2) to induce qualification outcome dependent on the result of test B_1 by the auditor; (3) to encourage the auditor to employ

test A_1; and (4) to induce the auditee to make high effort and selection of test A_1 and qualification outcome dependent on the result of test B_1 through the behavioural effect of the audit.

In policy objective (1) above, it is shown that the auditee is indifferent to damages greater than the audit risk except for spaces 4, 5.1, 5.2, 5.3, 5.4, and 5.5 (see Figure 19, page 168) when his relative damages are greater than 127. This implies that society could only influence in other spaces through damages imposed upon the auditor.

In policy objective (2) above, it is shown that the auditor has chosen test B_1 (space 3) within all the patterns.

The combination of the policy (1) and (2) which we have considered tells us that if society adopts a policy towards the audit which encourages high effort by the auditees and qualification outcome dependent on the result of test B_1, then it is looking ideally for the parties to adopt the space 3 (H_{1X}). Note that this space is in all patterns including the overlapped ones, and the cheapest pattern in term of inducement for society is pattern One.

In policy objective (3) above, society must offer an inducement in the form of a discount on the damages suffered by the auditor in the event of a failure to qualify a materially inaccurate set of statements. This implies that society perceives the function of the audit as being necessarily a qualification outcome contingent on the auditee's choice. It is seen that an inducement of at least 0.76 (Figure 14, page 146) is necessary for the auditor to employ test A_1 which reveals the auditee's strategy.

Note that pattern Two has an inducement of $0.76 >= n >= 0.67$, meaning that society gives up between twenty-four and thirty-three percent of the total damages otherwise suffered by the auditor in the event of a failure to qualify a materially inaccurate set of statements. A choice of this space and "n" is the cheapest way for society to get high effort from the auditee and the most rigorous audit.

The policy objective (4) above combines the three other policy objectives considered. This implies that society perceives the function of the audit as being necessarily a qualification outcome contingent on the auditee's choice and the signal of material error; however, only spaces 2.1, 2.2, 2.3, 2.4, and 2.5 through patterns two to four show that society perceives the function of the

audit as being to reveal the auditee's strategy and to find material error. A choice of spaces 2.1, 2.2, and 2.3 implies that society perceives the function of the audit as being to induce high effort on the part of the auditee and thus reduce the likelihood of material error.

It is seen that society inducement "n" modifies firstly space 2 (H_{1X}, L_{2K} and R) (pattern two and three) and secondly space 5 ($R_{R(2Z,1X)}$, pattern four). Only the spaces containing randomized strategies benefit from the inducement. The latter does not affect the pure unique strategy spaces.

It is shown through the patterns of this non-cooperative game that under a policy objective of maximizing auditor effort, setting the damages too high or too low results in the auditor adopting a strategy with the audit opinion (qualified or non-qualified) being indifferent to the results of the audit. There is a need for damages, but extreme damages levels are counterproductive. The auditee and the auditor frequently use a randomized strategy; that is, sometimes additional effort is used and sometimes it is not used. This result is analogous to Fellingham and Newman (1985).

CONCLUSION

The aim of this investigation has been to help society to understand audit policies accompanied by a properly managed damages regime. We argue that society should give properly managed incentive to the auditor and that it is better off with the cooperative than the non-cooperative game since the same outcomes are achieved at lower cost.

Using a rudimentary game theoretical model of the audit, through cooperative and non-cooperative game, we have explored how the auditee's and auditor's strategic choices are influenced by damages imposed on them for issuing a materially inaccurate set of statements without a qualified audit opinion. We have observed the effects of damages and inducement on the function of audit. Appropriate audit policies are revealed to suit different objectives or attitudes toward the audit on the part of society. Moreover, we argue for the cooperative game as the choice for society. Lastly, we enumerate some limitations and suggestions for future research.

Attitudes toward the audit

The discussions centre on four possible attitudes that society may take towards the work performed by the auditee and the auditor. The first attitude is that the auditee should be employing high levels of effort in order to reduce the probability of material error. The second attitude is that the auditor should be employing powerful quantitative tests in order to increase the probability of any material error being discovered. The third attitude is that the auditor should be employing qualitative tests in order to reveal the auditee's strategy. The fourth attitude is that both the auditee and the auditor should be employing high levels of effort; the auditee in order to reduce the probability of material error, and the auditor to reveal the auditee's strategy and increase the probability of any material error being discovered. Each of these attitudes is investigated whilst varying the level of damages associated with a non-qualified opinion (NQ) when the state of accounting information is in error (E).

The first attitude considered concerns society's influence over the auditee effort. If society adopts a policy towards the audit which encourages a pure strategy of high effort by the auditees, then this implies the adoption of damages levels associated with spaces 3 and 4. Damages (D^{NQ}_{E}) are approximately identical through all the patterns revealed within the cooperative and non-

cooperative games.

The second attitude considered concerns society's influence over the auditor's effort to uncover a material error. If society adopts a policy towards the audit which encourages a qualification outcome dependent on the result of a powerful quantitative test (test B_1 in our setting) used by the auditor then this implies the adoption of space 3. This space is sustained through all the patterns revealed within the cooperative and non-cooperative games, although, from pattern seven in the cooperative game, it implies that society cannot induce this strategic choice by damages on the auditor alone.

The third attitude considered concerns society's influence over the auditor's effort to reveal the auditee's strategy. If society adopts a policy towards the audit which encourages the auditor to employ test A_1, this implies the adoption of particular spaces within the cooperative games and the non-cooperative games.

A choice of some of the particular spaces within the non-cooperative games pinpoints the dilemma faced by an auditor who is choosing actions that affect the auditee. The auditor, by employing test A_1, can potentially influence the auditee to select a low level of care (spaces 5.1,...,5.5, page 168).

The fourth attitude considered concerns society's influence over the auditee's effort, and the auditor's effort to reveal the auditee's strategy and to uncover a material error. If society adopts a policy towards the audit which encourages the auditee to make high effort and selection of test A_1 and qualification outcome dependent on the result of test B_1, then it is looking ideally for the adoption of the space 3.1 within the cooperative game and of spaces with randomized strategies 2.1, 2.2, 2.3, 2.4, and 2.5 within the non-cooperative game.

Audit policies

The four explored attitudes suggest through a properly managed damages regime that the function of the audit is perceived to be: (1) to reduce the likelihood of a material error; (2) to reveal the auditee strategy; and (3) to both reduce the likelihood of a material error and reveal the auditee strategy.

If society wants to reduce the likelihood of a material error, it could adopt the first, the second, or the first and second attitudes through a choice of a properly managed range of damages for the auditee, the auditor, and the auditee and the auditor.

A choice to induce high effort on the part of the auditee alone implies that society wants to reduce the likelihood of material error at the basic level and emphasizes the auditee's responsibility for inaccurate financial statements.

A choice to induce high effort on the part of the auditor alone implies that society wants to reduce the likelihood of material error at the detection level and emphasizes the auditor's responsibility for inaccurate financial statements.

However, if society adopts a policy towards the audit which encourages randomized effort; that is, sometimes additional effort is used and sometimes it is not, by the auditee, then this implies that: (1) society takes a "portfolio" view and is not so concerned with what happens on individual audits; and (2) society perceives the function of the audit as being to recognize different expected utility from the players within the non-cooperative game, and allows some uncertainty about the auditee strategy which encourages the auditor to work. Note that the latter attitude is available only through the patterns revealed within the non-cooperative game.

Let us see what happens if society combines the two attitudes considered above, meaning that society's main

concern is to find material error. If society adopts a policy towards the audit which encourages the auditee to make high effort and a qualification outcome dependent on the result of test B_1, then it is looking ideally for the parties to adopt space 3. This space is found in all the patterns revealed including the overlapped patterns.

Note that there is an element of trust since the auditor does not play the test A_1 to check that the auditee is carrying out the agreed auditee strategy; furthermore, if there is a material error in the audited financial statements, the auditee as well as the auditor, no matter what game they play, will bear some risk because of it.

If society wants the auditor to reveal the auditee strategy, it could adopt the third attitude through a choice of a properly managed range of damages and of inducement for the auditor.

A choice to reveal the auditee strategy through an incentive implies that society wants to be secure that the auditee strategy has been carried out and to induce the auditor to reveal it.

If society wants to reduce the likelihood of a material error and the auditee strategy to be revealed, it could adopt the fourth attitude through a choice of a properly

managed range of damages for the auditee and the auditor and of inducement for the auditor.

A choice of damages from these spaces, within their respective patterns and games, implies that society perceives the function of the audit as being to induce the highest effort by the auditee and the most rigorous audit work by the auditor.

Influence of damages

The illustrations show that the auditee and the auditor are influenced by society's set of damages; however, these damages must be established within a specific range of "n", which is the inducement for the auditor to play A_1, and spaces corresponding to a range of auditee/auditor damages, the choice of "n" and spaces being dependent upon the policy objectives of society.

Influence of inducement

Two policy implications concern society's inducement "n". The analysis indicates that society may have strong incentives to support a link between "n" and the work of the auditor.

Some factors support society giving an inducement. Pre-commitments, when the auditor does not know the auditee strategy, cannot be enforced because the auditee's strategy cannot be observed; moreover, the auditee's communication of the strategy chosen does not eliminate the uncertainty since the audit decision must depend on evidence collected, not on the communications of the auditee. The inducement is critical to the auditor's decision to include the qualitative test within his strategy.

It is shown that society's inducement and a specific range of damages modify firstly space 3 (pattern two, page 109) of cooperative game and space 2 (pattern two, page 158) of non-cooperative game. These spaces fulfil the policy objective (4) to induce the auditee to make a high effort and the auditor to select the test revealing the auditee's strategy and to make a qualification outcome dependent on whether the result of the test signals a material error. This policy demands the most work from the auditee and the auditor and provides the greatest payoff for society.

Society's inducement "n" in a cooperative game can extend benefits to all spaces except the space 1 (L_{2K}, pattern 7, page 125), although in a non-cooperative game it can only extend benefits to two randomized strategy spaces (2 and

5, pattern 4, page 168). A society's inducement "n" of 0.76 or less could influence the auditor to employ test A_1 without consideration of the type of game.

Some strategies appear in the same space for some range of inducement "n" and of damages; for example, Figure 21 (page 177) shows that space 3 (pattern two, page 109) of cooperative game overlaps space 2 (pattern two, page 158) of non-cooperative game; consequently, we cannot differentiate between the types of game used by the auditee and the auditor. These latter spaces pinpoint the fact that the extremes of cooperation and no cooperation are not delineated within our audit setting.

Cooperative or non-cooperative game

The illustrations of the overlap pattern two (page 177) show that society could get the most demanding work from auditee and auditor within a cooperative or a non-cooperative game if it manages properly its damages regime and its inducement. The choice for society based on the cheapest cost and the same choice of strategies from the auditee and the auditor is a cooperative game; consequently, if society could manage properly its damages regime and inducement, this would imply lowest cost for society.

It is shown that society should give a greater inducement to the auditor to employ the test which reveals the auditee strategy in a non-cooperative game than in a cooperative game; for example, society gives only five percent within the cooperative game compared to twenty-four percent within the non-cooperative game before the auditor employs the test A_1. There is a lot of room between these two types of games which encourages auditor to play a cooperative game.

It is seen within only the cooperative game that the auditor gives an audit opinion contingent upon the signal of test B (space 3 and 3.1) only when he selects test B_1.

The cooperative and non-cooperative games show that under a policy objective of maximizing the auditee effort, setting the damages too high or too low results in the auditee adopting a low level of care; however, only the cooperative game shows that under a policy objective of maximizing the auditor effort, setting the damages too high or too low results in the auditor adopting a dominant strategy, with the audit opinion (qualified or non-qualified) being indifferent to the results of the audit. There is a need for damages, but extreme damages levels are counterproductive.

The auditee and the auditor, within the non-cooperative

game, frequently use a randomized strategy. This result is analogous to Fellingham and Newman (1985) and Anderson and Young (1988).

Of course, given the arbitrary nature of the cost parameters in these examples, the sensitivity over only three variables, the discrete nature of strategies, and the simple nature of this game, these results should not be taken literally; nevertheless, they illustrate the inherent strategic nature of the audit problem and the rationale of behaviourists regarding the incentive effects of auditing.

It should be emphasized that relationships between payoffs and strategies derived in this model are based on an extremely stylized audit setting. The extent to which this model provides useful explanations of auditee and auditor behaviour is limited. A much larger and more complex game involving many participants and multifaceted strategies could show other conclusions.

In this dissertation, a two-player game model has been used because: (1) it fits; owners, etc. rarely play a part in the game in reality; (2) it is manageable from a games theory perspective; and (3), a regulator and/or a court (operating on behalf of society) can be introduced to function on behalf of other players such as owners.

Limitation

The model used in this dissertation has many limitations. Sensitivity is only explored with respect to two damages, and the assignment of values to other costs is arbitrary. It does not consider the possibility that the auditee wishes to deceive. The audit is characterized as a rather simple three step process. The possibility of a damages regime offering inducements to the auditee as well as, or instead of, the auditor is not considered. The audit is characterized as a cooperative game, but a fee bargaining solution is not investigated.

All players are risk neutral, implying that they are acting as perfectly motivated representatives of groups of well-diversified auditees and auditors. In practice, however, individual differences are greater than group differences; therefore, more detailed consideration of the individual preferences of the auditee in charge of the firm and the auditor in charge of the audit might lead to differences in the basic results.

We assume a game of complete information; that is, one in which the rules of the game are common knowledge among players. The player "i" knows the rules, he knows that other players know the rules, he knows that the other

players know that he knows the rules, etc. In contrast, a game of incomplete information is one in which the rules of the game are not common knowledge among the players. In such a game there is some asymmetry in the information possessed by the players even at the start of the game.

Quite often in real world situations, one or more players misunderstand the true nature of the relation. This difference in perception between the auditee and the auditor affects the decision-making process, and can lead to unexpected results.

In the simplest, incomplete information game, players have rational expectations and common knowledge about the uncertainty each player faces. It is assumed that there is some pool of common knowledge about the environment that is shared by all participants. Most real-world games are games of incomplete information, mainly for three reasons: first, one player often does not know the motivations of the other player; second, one player often does not know the "technological capabilities" of the other players; that is, he does not know the feasible set of action of the other players; and finally, players differ in their knowledge of the world.

Games with mixed-strategy equilibria pose difficult

inference problems because the researcher does not know whether an action reflects a randomized or a pure-strategy equilibrium outcome. It is well known that there are often multiple Nash equilibria in games, and that these equilibria do not necessarily provide the players with the same expected utility.

Since in the model the effort underlying reported financial statements is binary; that is, belongs to [L,H], while there is in fact a continuous distribution of auditee effort over [0,1], reported financial statements only imperfectly reveal the auditee's private information; nevertheless, partitioning the distribution of auditee types into two groups, based upon the effort underlying reported financial statements, provides additional information to the auditor.

Although the game model used here is still controversial, there is enough evidence that potential contributions of the game view-point are vast; nevertheless, this dissertation serves to demonstrate clearly the importance of a properly managed damages regime for the control of auditee and auditor behaviour.

Many of these points can be investigated by further research.

Future areas for research

Further research could be done on: a fee bargaining solution within the cooperative game to suggest fee structure; an inducement to the auditee in respect to reduced damage; the order of auditee and auditor damages under a different environment such as fraud; a different order of auditee and auditor damage; the nature of the relationship between the auditee or auditor and strategy; knowledge or no knowledge of accounting effort, which should really be modelled as a partially observable game or hypergame; and portfolio of auditors accounts to maximize payoff and minimize risk using actual payoff of game instead of expected payoff.

APPENDICES

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1K}	$A_2:B_1$:	Q, Q	$[C_{B1} + rpC^{Q}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{B1} + rqC^{Q}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{1X}	$A_2:B_1$:	Q,NQ	$[C_{B1} + rpC^{Q}_{E} + (1-r)pC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{B1} + rqC^{Q}_{E} + (1-r)qC^{NQ}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{1Y}	$A_2:B_1$:	NQ, Q	$[C_{B1} + rpC^{NQ}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{B1} + rqC^{NQ}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{1Z}	$A_2:B_1$:	NQ,NQ	$[C_{B1} + rpC^{NQ}_{E} + (1-r)pC^{NQ}_{E} + t(1-p)C^{NQ^{NE}}_{NE} + (1-t)(1-p)C^{NQ^{NE}}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ^{NE}}_{NE}]$	$[C_{B1} + rqC^{NQ}_{E} + (1-r)qC^{NQ}_{E} + t(1-q)C^{NQ^{NE}}_{NE} + (1-t)(1-q)C^{NQ^{NE}}_{NE}$, $rqD^{NQ^{NE}}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{2K}	$A_2:B_2$:	Q, Q	$[vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{2X}	$A_2:B_2$:	Q,NQ	$[vpC^{Q}_{E} + (1-v)pC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[vqC^{Q}_{E} + (1-v)qC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{2Y}	$A_2:B_2:$	NQ, Q	$[vpC^{NQ}_E + (1-v)pC^{Q}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{Q}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[vqC^{NQ}_E + (1-v)qC^{Q}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{Q}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{2Z}	$A_2:B_2:$	NQ,NQ	$[vpC^{NQ}_E + (1-v)pC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[vqC^{NQ}_E + (1-v)qC^{NQ}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{NQ}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{1K1K}	$H,B_1:$ $L,B_1:$	Q, Q Q, Q	$[C_{A1} + C_{B1} + rpC^{Q}_E + (1-r)pC^{Q}_E + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_E + (1-r)pD^{Q}_E + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qC^{Q}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_E + (1-r)qD^{Q}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{1K1X}	$H,B_1:$ $L,B_1:$	Q, Q Q,NQ	$[C_{A1} + C_{B1} + rpC^{Q}_E + (1-r)pC^{Q}_E + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_E + (1-r)pD^{Q}_E + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{E\,NE} + (1-r)qD^{NQ}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{1K1Y}	$H,B_1:$ $L,B_1:$	Q, Q NQ, Q	$[C_{A1} + C_{B1} + rpC^{Q}_E + (1-r)pC^{Q}_E + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_E + (1-r)pD^{Q}_E + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qC^{Q}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_E + (1-r)qD^{Q}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$

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S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1K1Z}	H, B_1: L, B_1:	Q, Q NQ, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]
s_{1X1K}	H, B_1: L, B_1:	Q, NQ Q, Q	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}$]
s_{1X1X}	H, B_1: L, B_1:	Q, NQ Q, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]
s_{1X1Y}	H, B_1: L, B_1:	Q, NQ NQ, Q	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}$]
s_{1X1Z}	H, B_1: L, B_1:	Q, NQ NQ, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]

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S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1Y1K}	H, B_1: L, B_1:	NQ, Q Q, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pC^{Q}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_E + (1-r)pD^{Q}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qC^{Q}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_E + (1-r)qD^{Q}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{1Y1X}	H, B_1: L, B_1:	NQ, Q Q, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pC^{Q}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_E + (1-r)pD^{Q}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_E + (1-r)qD^{NQ}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{1Y1Y}	H, B_1: L, B_1:	NQ, Q NQ, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pC^{Q}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_E + (1-r)pD^{Q}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qC^{Q}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_E + (1-r)qD^{Q}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{1Y1Z}	H, B_1: L, B_1:	NQ, Q NQ, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pC^{Q}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_E + (1-r)pD^{Q}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_E + (1-r)qD^{NQ}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{1Z1K}	H, B_1: L, B_1:	NQ, NQ Q, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pnC^{NQ}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_E + (1-r)pD^{NQ}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qC^{Q}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_E + (1-r)qD^{Q}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1Z1X}	H, B_1: L, B_1:	NQ, NQ Q, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pnC^{NQ}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{NE} + (1-r)pD^{NQ}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{NE} + (1-r)qD^{NQ}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]
s_{1Z1Y}	H, B_1: L, B_1:	NQ, NQ NQ, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pnC^{NQ}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{NE} + (1-r)pD^{NQ}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qC^{Q}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{Q}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}$]
s_{1Z1Z}	H, B_1: L, B_1:	NQ, NQ NQ, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_E + (1-r)pnC^{NQ}_E + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{NE} + (1-r)pD^{NQ}_E + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{NQ}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]
s_{1K2K}	H, B_1: L, B_2:	Q, Q Q, Q	$[C_{A1} + C_{B1} + rpC^{Q}_E + (1-r)pC^{Q}_E + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_E + (1-r)pD^{Q}_E + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqC^{Q}_E + (1-v)qC^{Q}_E + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_E + (1-v)qD^{Q}_E + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]
s_{1K2X}	H, B_1: L, B_2:	Q, Q Q, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_E + (1-r)pC^{Q}_E + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_E + (1-r)pD^{Q}_E + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqC^{Q}_E + (1-v)qnC^{NQ}_E + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{NE} + (1-v)qD^{NQ}_E + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}$]

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1K2Y}	H, B_1: L, B_2:	Q, Q NQ, Q	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{1K2Z}	H, B_1: L, B_2:	Q, Q NQ, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{1X2K}	H, B_1: L, B_2:	Q, NQ Q, Q	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{1X2X}	H, B_1: L, B_2:	Q, NQ Q, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{1X2Y}	H, B_1: L, B_2:	Q, NQ NQ, Q	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1X2Z}	H, B_1: L, B_2:	Q, NQ NQ, NQ	$[C_{A1} + C_{B1} + rpC^{Q}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{Q}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{Q}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{Q}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{1Y2K}	H, B_1: L, B_2:	NQ, Q Q, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{1Y2X}	H, B_1: L, B_2:	NQ, Q Q, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{1Y2Y}	H, B_1: L, B_2:	NQ, Q NQ, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{1Y2Z}	H, B_1: L, B_2:	NQ, Q NQ, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pC^{Q}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{Q}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{Q}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{1Z2K}	H, B_1: L, B_2:	NQ, NQ Q, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{1Z2X}	H, B_1: L, B_2:	NQ, NQ Q, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{1Z2Y}	H, B_1: L, B_2:	NQ, NQ NQ, Q	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{1Z2Z}	H, B_1: L, B_2:	NQ, NQ NQ, NQ	$[C_{A1} + C_{B1} + rpnC^{NQ}_{E} + (1-r)pnC^{NQ}_{E} + t(1-p)C^{NQ}_{NE} + (1-t)(1-p)C^{NQ}_{NE}$, $D_H + rpD^{NQ}_{E} + (1-r)pD^{NQ}_{E} + t(1-p)D^{NQ}_{NE} + (1-t)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{2K1K}	H, B_2: L, B_1:	Q, Q Q, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
S_{2K1X}	H, B_2: L, B_1:	Q, Q Q, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]
S_{2K1Y}	H, B_2: L, B_1:	Q, Q NQ, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}$]
S_{2K1Z}	H, B_2: L, B_1:	Q, Q NQ, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]
S_{2X1K}	H, B_2: L, B_1:	Q, NQ Q, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}$]
S_{2X1X}	H, B_2: L, B_1:	Q, NQ Q, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}$]

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{2X1Y}	H, B_2: L, B_1:	Q, NQ NQ, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{2X1Z}	H, B_2: L, B_1:	Q, NQ NQ, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{2Y1K}	H, B_2: L, B_1:	NQ, Q Q, Q	$[C_{A1} + vpnC^{NQ}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{2Y1X}	H, B_2: L, B_1:	NQ, Q Q, NQ	$[C_{A1} + vpnC^{NQ}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_{E} + (1-r)qnC^{NQ}_{E} + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_{E} + (1-r)qD^{NQ}_{E} + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{2Y1Y}	H, B_2: L, B_1:	NQ, Q NQ, Q	$[C_{A1} + vpnC^{NQ}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_{E} + (1-r)qC^{Q}_{E} + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_{E} + (1-r)qD^{Q}_{E} + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{2Y1Z}	H, B_2: L, B_1:	NQ, Q NQ, NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pC^{Q}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{Q}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_E + (1-r)qD^{NQ}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{2Z1K}	H, B_2: L, B_1:	NQ, NQ Q, Q	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qC^{Q}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{Q}_E + (1-r)qD^{Q}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{2Z1X}	H, B_2: L, B_1:	NQ, NQ Q, NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqC^{Q}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{Q}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{Q}_E + (1-r)qD^{NQ}_E + t(1-q)D^{Q}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$
s_{2Z1Y}	H, B_2: L, B_1:	NQ, NQ NQ, Q	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qC^{Q}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{Q}_{NE}$, $rqD^{NQ}_E + (1-r)qD^{Q}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{Q}_{NE}]$
s_{2Z1Z}	H, B_2: L, B_1:	NQ, NQ NQ, NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + C_{B1} + rqnC^{NQ}_E + (1-r)qnC^{NQ}_E + t(1-q)C^{NQ}_{NE} + (1-t)(1-q)C^{NQ}_{NE}$, $rqD^{NQ}_E + (1-r)qD^{NQ}_E + t(1-q)D^{NQ}_{NE} + (1-t)(1-q)D^{NQ}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
S_{2K2K}	H, B_2: L, B_2:	Q, Q Q, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]
S_{2K2X}	H, B_2: L, B_2:	Q, Q Q, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqC^{Q}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}$]
S_{2K2Y}	H, B_2: L, B_2:	Q, Q NQ, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]
S_{2K2Z}	H, B_2: L, B_2:	Q, Q NQ, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}$]
S_{2X2K}	H, B_2: L, B_2:	Q, NQ Q, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{2X2X}	H, B_2: L, B_2:	Q, NQ Q, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{2X2Y}	H, B_2: L, B_2:	Q, NQ NQ, Q	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{2X2Z}	H, B_2: L, B_2:	Q, NQ NQ, NQ	$[C_{A1} + vpC^{Q}_{E} + (1-v)pnC^{NQ}_{E} + w(1-p)C^{Q}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{Q}_{E} + (1-v)pD^{NQ}_{E} + w(1-p)D^{Q}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$
s_{2Y2K}	H, B_2: L, B_2:	NQ, Q Q, Q	$[C_{A1} + vpnC^{NQ}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qC^{Q}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{Q}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}]$
s_{2Y2X}	H, B_2: L, B_2:	NQ, Q Q, NQ	$[C_{A1} + vpnC^{NQ}_{E} + (1-v)pC^{Q}_{E} + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_{E} + (1-v)pD^{Q}_{E} + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}]$	$[C_{A1} + vqC^{Q}_{E} + (1-v)qnC^{NQ}_{E} + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_{E} + (1-v)qD^{NQ}_{E} + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$

A.1 Auditor-Auditee Game in Normal Form

S		O_M, O_{NM}	H [Auditor payoff, Auditee payoff]	L [Auditor payoff, Auditee payoff]
s_{2Y2Y}	H, B_2: L, B_2:	NQ, Q NQ, Q	$[C_{A1} + vpnC^{NQ}_E + (1-v)pC^{Q}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{Q}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqnC^{NQ}_E + (1-v)qC^{Q}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{Q}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]
s_{2Y2Z}	H, B_2: L, B_2:	NQ, Q NQ, NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pC^{Q}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{Q}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{Q}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{Q}_{NE}$]	$[C_{A1} + vqnC^{NQ}_E + (1-v)qnC^{NQ}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{NQ}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}$]
s_{2Z2K}	H, B_2: L, B_2:	NQ, NQ Q, Q	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + vqC^{Q}_E + (1-v)qC^{Q}_E + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{Q}_E + (1-v)qD^{Q}_E + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]
s_{2Z2X}	H, B_2: L, B_2:	NQ, NQ Q, NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + vqC^{Q}_E + (1-v)qnC^{NQ}_E + w(1-q)C^{Q}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{Q}_E + (1-v)qD^{NQ}_E + w(1-q)D^{Q}_{NE} + (1-w)(1-q)D^{NQ}_{NE}$]
s_{2Z2Y}	H, B_2: L, B_2:	NQ, NQ NQ, Q	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}$]	$[C_{A1} + vqnC^{NQ}_E + (1-v)qC^{Q}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{Q}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{Q}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{Q}_{NE}$]

A.1 Auditor-Auditee Game in Normal Form

			H	L
S		O_M, O_{NM}	[Auditor payoff, Auditee payoff]	[Auditor payoff, Auditee payoff]
s_{2222}	H, B_2: L, B_2:	NQ,NQ NQ,NQ	$[C_{A1} + vpnC^{NQ}_E + (1-v)pnC^{NQ}_E + w(1-p)C^{NQ}_{NE} + (1-w)(1-p)C^{NQ}_{NE}$, $D_H + vpD^{NQ}_E + (1-v)pD^{NQ}_E + w(1-p)D^{NQ}_{NE} + (1-w)(1-p)D^{NQ}_{NE}]$	$[C_{A1} + vqnC^{NQ}_E + (1-v)qnC^{NQ}_E + w(1-q)C^{NQ}_{NE} + (1-w)(1-q)C^{NQ}_{NE}$, $vqD^{NQ}_E + (1-v)qD^{NQ}_E + w(1-q)D^{NQ}_{NE} + (1-w)(1-q)D^{NQ}_{NE}]$

A.2 Choice of strategies

Table 1

	Non-Coop		Coop	
	H Min	L Min	H Min	L Min
Table.1	11.50	18.80	56.50	30.50
.2	19.50	23.80	64.50	38.50
.3	19.50	24.78	64.50	35.50
.4	16.50	23.80	61.50	38.50
.5	16.50	24.78	61.50	35.50
MINIMUM	11.50	18.80	56.50	30.50

Fixed parameters

$D_H = 35$ $D^Q_E = 220$ $D^Q_{NE} = 40$ $D^{NQ}_{NE} = 10$

$C_{A1} = 5$ $C_{B1} = 3$ $C^Q_E = 20$ $C^Q_{NE} = 40$ $C^{NQ}_{NE} = 10$

$p = 0.05$ $q = 0.35$
$r = 0.95$ $t = 0.10$ $v = 0.80$ $w = 0.25$

Variable parameters

$C^{NQ}_E = 40$ $D^{NQ}_E = 10$ $n = 1.00$

Table 1 .1

S	H Audi-tor	H Audi-tee	L Audi-tor	L Audi-tee	H Coop	L Coop
S_{1K}	42.00	160.00	36.00	155.00	202.00	191.00
S_{1X}	16.40	65.43	18.80	86.98	81.83	105.78
S_{1Y}	40.10	139.58	40.70	78.03	179.68	118.73
S_{1Z}	14.50	45.00	23.50	10.00	59.50	33.50
S_{2K}	39.00	160.00	33.00	155.00	199.00	188.00
S_{2X}	17.83	79.53	19.78	86.68	97.35	106.45
S_{2Y}	32.68	125.48	33.73	78.33	158.15	112.05
S_{2Z}	11.50	45.00	20.50	10.00	56.50	30.50

A.2 Choice of strategies

Table 1 .2

S	H Auditor	H Auditee	L Auditor	L Auditee	H Coop	L Coop
S_{1K1K}	47.00	160.00	41.00	155.00	207.00	196.00
S_{1K1X}	47.00	160.00	23.80	86.98	207.00	110.78
S_{1K1Y}	47.00	160.00	45.70	78.03	207.00	123.73
S_{1K1Z}	47.00	160.00	28.50	10.00	207.00	38.50
S_{1X1K}	21.40	65.43	41.00	155.00	86.83	196.00
S_{1X1X}	21.40	65.43	23.80	86.98	86.83	110.78
S_{1X1Y}	21.40	65.43	45.70	78.03	86.83	123.73
S_{1X1Z}	21.40	65.43	28.50	10.00	86.83	38.50
S_{1Y1K}	45.10	139.58	41.00	155.00	184.68	196.00
S_{1Y1X}	45.10	139.58	23.80	86.98	184.68	110.78
S_{1Y1Y}	45.10	139.58	45.70	78.03	184.68	123.73
S_{1Y1Z}	45.10	139.58	28.50	10.00	184.68	38.50
S_{1Z1K}	19.50	45.00	41.00	155.00	64.50	196.00
S_{1Z1X}	19.50	45.00	23.80	86.98	64.50	110.78
S_{1Z1Y}	19.50	45.00	45.70	78.03	64.50	123.73
S_{1Z1Z}	19.50	45.00	28.50	10.00	64.50	38.50

A.2 Choice of strategies

Table 1 .3

S	H Auditor	H Auditee	L Auditor	L Auditee	H Coop	L Coop
S_{1K2K}	47.00	160.00	38.00	155.00	207.00	193.00
S_{1K2X}	47.00	160.00	24.78	86.68	207.00	111.45
S_{1K2Y}	47.00	160.00	38.73	78.33	207.00	117.05
S_{1K2Z}	47.00	160.00	25.50	10.00	207.00	35.50
S_{1X2K}	21.40	65.43	38.00	155.00	86.83	193.00
S_{1X2X}	21.40	65.43	24.78	86.68	86.83	111.45
S_{1X2Y}	21.40	65.43	38.73	78.33	86.83	117.05
S_{1X2Z}	21.40	65.43	25.50	10.00	86.83	35.50
S_{1Y2K}	45.10	139.58	38.00	155.00	184.68	193.00
S_{1Y2X}	45.10	139.58	24.78	86.68	184.68	111.45
S_{1Y2Y}	45.10	139.58	38.73	78.33	184.68	117.05
S_{1Y2Z}	45.10	139.58	25.50	10.00	184.68	35.50
S_{1Z2K}	19.50	45.00	38.00	155.00	64.50	193.00
S_{1Z2X}	19.50	45.00	24.78	86.68	64.50	111.45
S_{1Z2Y}	19.50	45.00	38.73	78.33	64.50	117.05
S_{1Z2Z}	19.50	45.00	25.50	10.00	64.50	35.50

A.2 Choice of strategies

Table 1 .4

S	H Auditor	H Auditee	L Auditor	L Auditee	H Coop	L Coop
S_{2K1K}	44.00	160.00	41.00	155.00	204.00	196.00
S_{2K1X}	44.00	160.00	23.80	86.98	204.00	110.78
S_{2K1Y}	44.00	160.00	45.70	78.03	204.00	123.73
S_{2K1Z}	44.00	160.00	28.50	10.00	204.00	38.50
S_{2X1K}	22.83	79.53	41.00	155.00	102.35	196.00
S_{2X1X}	22.83	79.53	23.80	86.98	102.35	110.78
S_{2X1Y}	22.83	79.53	45.70	78.03	102.35	123.73
S_{2X1Z}	22.83	79.53	28.50	10.00	102.35	38.50
S_{2Y1K}	37.68	125.48	41.00	155.00	163.15	196.00
S_{2Y1X}	37.68	125.48	23.80	86.98	163.15	110.78
S_{2Y1Y}	37.68	125.48	45.70	78.03	163.15	123.73
S_{2Y1Z}	37.68	125.48	28.50	10.00	163.15	38.50
S_{2Z1K}	16.50	45.00	41.00	155.00	61.50	196.00
S_{2Z1X}	16.50	45.00	23.80	86.98	61.50	110.78
S_{2Z1Y}	16.50	45.00	45.70	78.03	61.50	123.73
S_{2Z1Z}	16.50	45.00	28.50	10.00	61.50	38.50

A.2 Choice of strategies

Table 1 .5

S	H Auditor	H Auditee	L Auditor	L Auditee	H Coop	L Coop
S_{2K2K}	44.00	160.00	38.00	155.00	204.00	193.00
S_{2K2X}	44.00	160.00	24.78	86.68	204.00	111.45
S_{2K2Y}	44.00	160.00	38.73	78.33	204.00	117.05
S_{2K2Z}	44.00	160.00	25.50	10.00	204.00	35.50
S_{2X2K}	22.83	79.53	38.00	155.00	102.35	193.00
S_{2X2X}	22.83	79.53	24.78	86.68	102.35	111.45
S_{2X2Y}	22.83	79.53	38.73	78.33	102.35	117.05
S_{2X2Z}	22.83	79.53	25.50	10.00	102.35	35.50
S_{2Y2K}	37.68	125.48	38.00	155.00	163.15	193.00
S_{2Y2X}	37.68	125.48	24.78	86.68	163.15	111.45
S_{2Y2Y}	37.68	125.48	38.73	78.33	163.15	117.05
S_{2Y2Z}	37.68	125.48	25.50	10.00	163.15	35.50
S_{2Z2K}	16.50	45.00	38.00	155.00	61.50	193.00
S_{2Z2X}	16.50	45.00	24.78	86.68	61.50	111.45
S_{2Z2Y}	16.50	45.00	38.73	78.33	61.50	117.05
S_{2Z2Z}	16.50	45.00	25.50	10.00	61.50	35.50

A.3 Extracts of choice of combined strategies

Table 2

	Non-Coop		Coop	
	H	L	H	L
	Min	Min	Min	Min
Table .1	15.80	20.31	60.80	60.60
.2	21.62	25.31	68.80	68.60
.3	21.62	30.80	68.80	65.60
.4	20.80	25.31	65.80	68.60
.5	20.80	30.80	65.80	65.60
MINIMUM	15.80	20.31	60.80	60.60

Variable parameters

C^{NQ}_{E} = 126 D^{NQ}_{E} = 10 n = 1.00

Table 2 .1

S	H Audi-tor	H Audi-tee	L Audi-tor	L Audi-tee	H Coop	L Coop
S_{1K}	42.00	160.00	36.00	155.00	202.00	191.00
S_{1X}	16.62	65.43	20.31	86.98	82.04	107.28
S_{1Y}	44.19	139.58	69.29	78.03	183.76	147.32
S_{1Z}	18.80	45.00	53.60	10.00	63.80	63.60
S_{2K}	39.00	160.00	33.00	155.00	199.00	188.00
S_{2X}	18.69	79.53	25.80	86.68	98.21	112.47
S_{2Y}	36.12	125.48	57.81	78.33	161.59	136.13
S_{2Z}	15.80	45.00	50.60	10.00	60.80	60.60

A.3 Extracts of choice of combined strategies

Table 3

	Non-Coop		Coop	
	H Min	L Min	H Min	L Min
Table .1	15.85	20.32	60.85	60.95
.2	21.62	25.32	68.85	68.95
.3	21.62	30.87	68.85	65.95
.4	20.85	25.32	65.85	68.95
.5	20.85	30.87	65.85	65.95
MINIMUM	15.85	20.32	60.85	60.95

Variable parameters

C^{NQ}_{E} = 127 D^{NQ}_{E} = 10 n = 1.00

Table 3 .1

S	H Auditor	H Auditee	L Auditor	L Auditee	H Coop	L Coop
S_{1K}	42.00	160.00	36.00	155.00	202.00	191.00
S_{1X}	16.62	65.43	20.32	86.98	82.04	107.30
S_{1Y}	44.23	139.58	69.29	78.03	183.76	147.32
S_{1Z}	18.85	45.00	53.95	10.00	63.85	63.95
S_{2K}	39.00	160.00	33.00	155.00	199.00	188.00
S_{2X}	18.70	79.53	25.87	86.68	98.22	112.54
S_{2Y}	36.16	125.48	58.09	78.33	161.63	136.41
S_{2Z}	15.85	45.00	50.95	10.00	60.85	60.95

A.4 Extracts of choice of joint strategies

Table 4

	Non-Coop		Coop	
	H	L	H	L
	Min	Min	Min	Min
Table .1	16.65	20.60	61.65	66.55
.2	21.66	25.60	69.65	74.55
.3	21.66	31.99	69.65	71.55
.4	21.65	25.60	66.65	74.55
.5	21.65	31.99	66.65	71.55
MINIMUM	16.65	20.60	61.65	66.55

Variable parameters

$C^{NQ}_{E} = 143$ $D^{NQ}_{E} = 10$ $n = 1.00$

Table 4 .1

	H	H	L	L	H	L
S	Audi-tor	Audi-tee	Audi-tor	Audi-tee	Coop	Coop
S_{1K}	42.00	160.00	36.00	155.00	202.00	191.00
S_{1X}	16.66	65.43	20.60	86.98	82.08	107.58
S_{1Y}	44.99	139.58	74.95	78.03	184.57	152.97
S_{1Z}	19.65	45.00	59.55	10.00	64.65	69.55
S_{2K}	39.00	160.00	33.00	155.00	199.00	188.00
S_{2X}	18.86	79.53	26.99	86.68	98.38	113.66
S_{2Y}	36.80	125.48	62.57	78.33	162.27	140.89
S_{2Z}	16.65	45.00	56.55	10.00	61.65	66.55

A.4 Extracts of choice of joint strategies

Table 5

	Non-Coop		Coop	
	H	L	H	L
	Min	Min	Min	Min
Table .1	16.66	20.62	61.70	66.90
.2	21.66	25.62	69.70	74.90
.3	21.66	32.06	69.70	71.90
.4	21.70	25.62	66.70	74.90
.5	21.70	32.06	66.70	71.90
MINIMUM	16.66	20.62	61.70	66.90

Variable parameters

$C^{NQ}_E = 144$ $D^{NQ}_E = 10$ n = 1.00

Table 5 .1

S	H Auditor	H Auditee	L Auditor	L Auditee	H Coop	L Coop
S_{1K}	42.00	160.00	36.00	155.00	202.00	191.00
S_{1X}	16.66	65.43	20.62	86.98	82.09	107.60
S_{1Y}	45.04	139.58	75.28	78.03	184.57	153.31
S_{1Z}	19.70	45.00	59.90	10.00	64.70	69.90
S_{2K}	39.00	160.00	33.00	155.00	199.00	188.00
S_{2X}	18.87	79.53	27.06	86.68	98.38	113.73
S_{2Y}	36.84	125.48	62.85	78.33	162.31	141.17
S_{2Z}	16.70	45.00	56.90	10.00	61.70	66.90

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